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# Environmental Assessment for Conventional Strike Missile Demonstration

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August 2010

REPORT DOCUMENTATION PAGE					Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY)		2. REPORT TYPE		3. DATES COVERED (From - To)		
11-08-2010		Final NEPA Document		Jan 2009 to Aug 2010		
4. TITLE AND SUBTITLE  Final Environmental Assessment for Conventional Strike Missile Demonstration				5a. CONTRACT NUMBER W9113M-08-D-001		
				5b. GRANT NUMBER N/A		
				5c. PROGRAM ELEMENT NUMBER N/A		
6. AUTHOR(S)  Huynh, Thomas (SMC/EAF) Aragon, Leonard (SMC/EAFV) Kriz, Joseph (Teledyne Solutions, Inc.)				5d. PROJECT NUMBER N/A		
				5e. TASK NUMBER N/A		
				5f. WORK UNIT NUMBER N/A		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  Teledyne Solutions, Inc. 5000 Bradford Drive NW, Suite 200 Huntsville, AL 35805				8. PERFORMING ORGANIZATION REPORT NUMBER  N/A		
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				11. SPONSOR/MONITOR'S REPORT NUMBER(S) EAF-2010-04		
12. DISTRIBUTION/AVAILABILITY STATEMENT  Approved for public release; distribution is unlimited						
13. SUPPLEMENTARY NOTES  Prepared for: SMC/XR, Los Angeles Air Force Base, CA						
14. ABSTRACT  This EA documents the potential environmental impacts of conducting a single demonstration flight test of the Conventional Strike Missile (CSM). The CSM Demonstration flight test vehicle would be launched from Vandenberg Air Force Base, California, using an existing rocket booster system. Following booster separation, the Payload Delivery Vehicle would glide at hypersonic velocities in the upper atmosphere, prior to a land or ocean impact at the US Army Kwajalein Atoll/Reagan Test Site in the Republic of the Marshall Islands.						
15. SUBJECT TERMS						
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	
a. REPORT	b. ABSTRACT	c. THIS PAGE			Mr. Leonard Aragon	
Unclassified	Unclassified	Unclassified	SAR	231	19b. TELEPHONE NUMBER (include area code) (310) 653-1222	

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# **FINDING OF NO SIGNIFICANT IMPACT**

## **ENVIRONMENTAL ASSESSMENT FOR CONVENTIONAL STRIKE MISSILE DEMONSTRATION**

**AGENCY:** United States Air Force (USAF)

**BACKGROUND:** The USAF prepared an Environmental Assessment (EA) to evaluate the potential environmental consequences of conducting the Conventional Strike Missile (CSM) Demonstration flight test from Vandenberg Air Force Base (AFB) in California (CA) to the US Army Kwajalein Atoll (USAKA)/Reagan Test Site (RTS) in the Republic of the Marshall Islands (RMI). The attached EA, which is hereby incorporated by reference, was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969; Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions); Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); 32 CFR Part 989 (*Environmental Impact Analysis Process*); and the *Environmental Standards and Procedures for US Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands*, hereafter referred to as the USAKA Environmental Standards or UES.

The USAF's proposed CSM Demonstration flight test is part of the incremental development and demonstration of potential Conventional Prompt Global Strike (CPGS) systems, and it represents just one of several delivery system test beds being considered by the Department of Defense for future fielding. CSM is a ground launched, space traversing weapon system capable of transporting conventional (non-nuclear) payloads at intercontinental ranges. The CSM Demonstration would combine hypersonic glide technologies with an integrated particle dispersion payload. The flight test is needed to validate guidance and control requirements, and overall system performance.

**DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES:** The Proposed Action is to conduct a single CSM Demonstration flight test. As a rocket payload, the Payload Delivery Vehicle (PDV) would be launched from Vandenberg AFB using a Minotaur IV Lite booster. Following launch over the Pacific Ocean, the PDV would separate from the booster and glide at hypersonic velocities in the upper atmosphere towards the USAKA/RTS. Upon reaching the terminal end of the flight, the USAF intends for the vehicle to impact at one of two pre-designated, alternative locations: (1) a land site on Illeginni Islet at the USAKA/RTS or (2) a floating platform placed in the Broad Ocean Area (BOA) north of USAKA/RTS. The USAF's Preferred Alternative is to impact at Illeginni Islet. Although subject to change, the USAF plans to conduct the flight test in the late 2012 timeframe. The EA also analyzed the No Action Alternative to serve as the baseline against which the Proposed Action was evaluated.

**ENVIRONMENTAL EFFECTS:** The USAF assessed potential impacts of the Proposed Action at Vandenberg AFB, within the over-ocean flight corridor, and at USAKA/RTS and the Marshall Islands. Because environmental issues associated with the proposed CSM Demonstration vary widely at each location, the resources analyzed in each case also vary. For Vandenberg AFB, the following resources could be affected and were analyzed in the document: air quality, noise, biological resources, cultural resources, coastal zone management, water resources, health and safety, and hazardous materials and waste management. For USAKA/RTS, air quality, noise, biological resources, health and safety, and hazardous materials and waste management were analyzed. Within the over-ocean flight corridor, the global atmosphere and biological resources were assessed. The analyses for each location are summarized as follows.

### **Vandenberg AFB**

Air emissions from the base would be increased temporarily by site preparation and construction activities, and during the launch. Emission levels, however, would not exceed *de minimis* (minimal



importance) thresholds for criteria pollutants, be regionally significant, or contribute to a violation of Vandenberg AFB's air operating permits. The disturbance and removal of vegetation during the establishment of firebreaks and trenching activities is likely to "adversely affect" the Federally endangered El Segundo blue butterfly and the Federally threatened California red-legged frog. Because of the potential for adverse effects on these species, the USAF entered into formal consultation with the US Fish and Wildlife Service (USFWS). By implementing measures identified in the USFWS Biological Opinion provided in Appendix D of the EA, the USFWS concluded that the proposed activities would not jeopardize the continued existence of these two species.

Through application of best management practices, no impacts to water resources are expected during construction activities. Excavation work would be conducted in pre-disturbed areas and thus the activities are not expected to disturb known archaeological sites. Use of historic facilities would be minimal and short term. Site preparation activities and other necessary pre-launch activities would be consistent with the Vandenberg AFB General Plan. The USAF would comply with Federal Coastal Zone Consistency regulations and the California Coastal Zone Management Program. Launch noise would occur only once, be very short in duration, and have little effect on the CA Community Noise Equivalent Level for this area. Sonic booms would not impact the mainland or the northern Channel Islands. Based on prior monitoring studies, the rocket launch is expected to have a negligible, short-term impact on seals and sea lions, sea and shore birds, and other protected species.

The CSM Demonstration flight test represents routine types of activities at Vandenberg AFB. The launch will not create any Environmental Justice concerns. Allowable public risk limits for launch-related debris would be extremely low. All program-related hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable regulations. In terms of cumulative impacts, the proposed CSM Demonstration launch would represent an approximate 7 percent increase in the number of launches to be conducted at Vandenberg AFB in the 2012 timeframe.

### **Over-Ocean Flight Corridor and the Global Environment**

Regarding potential effects on the global atmosphere, emissions of ozone-depleting gases and greenhouse gases would be negligible compared to anthropogenic releases worldwide. The limited amount of emissions would not contribute significantly to cumulative global warming or stratospheric ozone depletion. Although the propagation of sonic booms underwater could cause auditory effects in marine animals and sea turtles, the effects are considered insignificant because of the limited area and duration of potential exposure to adverse sound levels, and the low density of animals in the open ocean. In response to consultations, the National Marine Fisheries Service concurred with the USAF's determination that conducting a single CSM Demonstration flight test from Vandenberg AFB to USAKA/RTS is not likely to adversely affect marine species or critical habitats protected under the ESA and RMI statutes.

### **USAKA/RTS**

For both the Preferred Alternative and the BOA Alternative, there would be no exceedance of UES air quality standards, no new permanent stationary sources of emissions, and no changes to air emission permits. RMI communities in the region would be exposed to PDV sonic booms, but only once within each community and at sound levels well within UES policies and US Army standards for impulse noise.

For the BOA Alternative, noise and debris impacts could have an adverse effect on protected marine mammals and sea turtles within the open ocean. However, the probability for animal injuries can be considered negligible because of low animal densities and the limited area of impact. For the Preferred Alternative at Illeginni Islet, noise and airborne vibrations would have minor impacts on migratory birds and the coral reef. Flight test debris impacts "may affect" protected sea turtles, sea turtle nesting habitat, and mollusks; however, the risks for adverse effects are low. By implementing measures identified in the USFWS Biological Opinion provided in Appendix F of the EA, the USFWS concluded that the proposed

activities would not jeopardize the continued existence of the Federally threatened green sea turtle and the Federally endangered hawksbill sea turtle.

The proposed flight test and impacts in the Marshall Islands would be conducted using the same USAKA/RTS range safety standards as those applied to other flight-test programs. Allowable public risk limits for flight vehicle debris are extremely low. Impact of the PDV would introduce small quantities of toxic metals, batteries, and explosive devices into the environment; however, post test operations would include the recovery of all visible test debris from the Illeginni Islet impact site or from the barges in the BOA. All hazardous and non-hazardous wastes would be properly disposed of in accordance with the UES. As for cumulative impacts, the proposed CSM Demonstration launch would represent a 17 to 20 percent increase in the overall number of hypersonic vehicle flight tests to be conducted at USAKA/RTS in the 2012 timeframe.

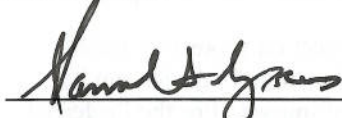
**ENVIRONMENTAL MANAGEMENT AND MONITORING ACTIONS:** Although no significant or other major impacts are expected to result from implementation of the Proposed Action, the USAF identified some specific environmental management and monitoring actions to minimize the level of impacts that might occur at Vandenberg AFB and at USAKA/RTS. These activities include briefing personnel on the sensitivity of cultural resources, monitoring for marine mammals and sea turtles prior to the flight test, and ensuring the proper disposal of construction wastes. Section 4.4 of the EA summarizes these and other measures to be implemented as part of the Proposed Action.

**PUBLIC REVIEW AND COMMENT:** At Vandenberg AFB, CA and at USAKA/RTS in the Marshall Islands, the USAF published an availability notice for public review of the Draft EA and Draft Finding of No Significant Impact (FONSI) in local newspapers on or about June 24, 2010, initiating a 30-day review period that ended on July 26, 2010. Because of an inadvertent failure of the *Kwajalein Hourglass* to publish the availability notice on schedule, the notice was published at a later date and the residents of USAKA/RTS were provided an extended review period that ended on August 2, 2010. The USAF placed copies of the Draft EA, including the Draft FONSI, in local libraries in California and the RMI, and on the Internet at <http://www.csm-ea.com>. Following the public review period (as specified in the newspaper notices and on the Internet), the USAF received no public comments. One agency, however, responded with comments on proposed activities at USAKA/RTS. The USAF has addressed these comments in the Final EA.

**POINT OF CONTACT:** The point of contact for questions, issues, and information relevant to the EA for the CSM Demonstration is Mr. Leonard Aragon, SMC/EAFV, 483 North Aviation Boulevard, El Segundo, CA, 90245-2808. Mr. Aragon also can be reached by calling (310) 653-1222, by facsimile at (310) 653-1210, or by e-mail at [Leonard.Aragon@losangeles.af.mil](mailto:Leonard.Aragon@losangeles.af.mil).

**CONCLUSION:** An analysis of the Proposed Action concludes that its implementation will not have a significant environmental impact on the human and natural environment, either by itself or cumulatively with other actions. After thoroughly considering the facts herein, the undersigned finds that the Proposed Action is consistent with existing environmental policies and objectives set forth in NEPA and its implementing regulations. Therefore, an Environmental Impact Statement is not required.

**APPROVED:**



SAMUEL A. GREAVES,  
Brigadier General, USAF  
Vice Commander  
Space and Missile Systems Center

25 Aug 10

DATE

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## ***ACRONYMS AND ABBREVIATIONS***

AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AFSPC	Air Force Space Command
AHW	Advanced Hypersonic Weapon
Al <sub>2</sub> O <sub>3</sub>	Aluminum Oxide
AQCR	Air-Quality Control Region
ARSTRAT	Army Forces Strategic Command
ASEL	A-Weighted Sound Exposure Level
BA	Biological Assessment
Be	Beryllium
BMP	Best Management Practice
BO	Biological Opinion
BOA	Broad Ocean Area
C	Celsius
CA	California
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCA	California Coastal Act
CCC	California Coastal Commission
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	Chlorofluorocarbons
CFR	Code of Federal Regulations
CH <sub>4</sub>	Methane
CITES	Convention on International Trade in Endangered Species
Cl	Chlorine
cm	Centimeter
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
CPGS	Conventional Prompt Global Strike
Cr	Chromium
CSM	Conventional Strike Missile
CY	Calendar Year
CZMA	Coastal Zone Management Act
DARPA	Defense Advanced Research Projects Agency
dB	Decibel
dBA	A-weighted Decibel
DEP	Department of Environmental Protection
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DU	Depleted Uranium
EA	Environmental Assessment
EDMS	Emissions and Dispersion Modeling System

EIS	Environmental Impact Statement
EPPSO	Economic Policy, Planning, and Statistics Office
ESA	Endangered Species Act
ESBB	El Segundo Blue Butterfly
F	Fahrenheit
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FR	Federal Register
ft	Feet
FTS	Flight Termination System
g	Grams
GCA	Guidance and Control Assembly
GFE	Government Furnished Equipment
GHG	Greenhouse Gases
HAP	Hazardous Air Pollutant
HCl	Hydrogen Chloride
HTV-2	Hypersonic Technology Vehicle 2
ICBM	Intercontinental Ballistic Missile
INRMP	Integrated Natural Resources Management Plan
IRF	Integration Refurbishment Facility
IRP	Installation Restoration Program
KEEP	Kwajalein Environmental Emergency Plan
kg	Kilogram
km	Kilometer
kph	Kilometers per Hour
kW	Kilowatt
lb	Pound
lbm	Pound-Mass
LBP	Lead-Based Paint
LCU	Landing Craft Utility
LEB	Launch Equipment Building
LF	Launch Facility
LLNL	Lawrence Livermore National Laboratory
LOA	Letter of Authorization
LTO	Landing and Take-off
m	Meter
MBCA	Migratory Bird Conservation Act
MDA	Missile Defense Agency
mi	Mile
MM	Minuteman
MMPA	Marine Mammal Protection Act
mph	Miles per Hour
N <sub>2</sub>	Nitrogen
N <sub>2</sub> O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
Ni	Nickel
NMFS	National Marine Fisheries Service
nmi	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration



NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NO <sub>x</sub>	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWHI	Northwestern Hawaiian Islands
O <sub>3</sub>	Ozone
OEPPC	Office of Environmental Planning and Policy Coordination
OSHA	Occupational Safety and Health Administration
OSP	Orbital/Sub-Orbital Program
Pb	Lead
PCB	Polychlorinated Biphenyl
PDV	Payload Delivery Vehicle
PFMC	Pacific Fishery Management Council
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns in diameter
PM <sub>10</sub>	Particulate Matter less than 10 microns in diameter
PPE	Personal Protective Equipment
PPF	Payload Processing Facility
ppm	Parts per Million
psf	Pounds per Square Foot
PTS	Permanent Threshold Shift
RCC	Range Commanders Council
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, and Test and Evaluation
RMI	Republic of the Marshall Islands
RMIEPA	RMI Environmental Protection Authority
RMS	Root-Mean-Square
ROI	Region of Influence
RTS	Reagan Test Site
RWQCB	Regional Water Quality Control Board
SBCAPCD	Santa Barbara County Air Pollution Control District
SEL	Sound Exposure Level
SHPO	State Historic Preservation Officer
SLC	Space Launch Complex
SMC	Space and Missile Systems Center
SO <sub>2</sub>	Sulfur Dioxide
SOC	Species of Concern
sqft	Square Feet
SRS	SRS Technologies
START	Strategic Arms Reduction Treaty
SW	Space Wing
SWI	Space Wing Instruction
TB	Technical Bulletin
TP-01	Test Pad-01
tpy	Tons per Year
TTS	Temporary Threshold Shift
TVC	Thrust Vector Control
U	Uranium
UES	USAKA Environmental Standards
UNEP-WCMC	United Nations Environment Programme–World Conservation Monitoring Centre

UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UPS	Uninterruptible Power Supply
US	United States
USAF	US Air Force
USAKA	US Army Kwajalein Atoll
USASMD	US Army Space and Missile Defense Command
USASSDC	US Army Space and Strategic Defense Command
USAV	US Army Vessel
USC	US Code
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USN	US Department of the Navy
USSTRATCOM	US Strategic Command
UXO	Unexploded Ordnance
VAFB	Vandenberg Air Force Base
VOC	Volatile Organic Compound
WMO	World Meteorological Organization
XR	Developmental Planning Directorate
µg	micrograms
µg/m <sup>3</sup>	micrograms per cubic meter
µPa	microPascal

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# 1.0 PURPOSE OF AND NEED FOR ACTION

## 1.1 INTRODUCTION

The Headquarters for the United States (US) Air Force Space Command (AFSPC) has tasked the Space and Missile Systems Center (SMC), Developmental Planning Directorate (XR), to conduct a single demonstration flight test of the Conventional Strike Missile (CSM). Flight-testing this test weapon system supports future US development of a Conventional Prompt Global Strike (CPGS) capability.

The CSM Demonstration flight test vehicle would be launched from facilities at Vandenberg Air Force Base (AFB), California (CA), using an existing rocket booster system. Following booster separation, the Payload Delivery Vehicle (PDV) would glide at hypersonic velocities in the upper atmosphere above the Pacific Ocean, prior to a land or ocean impact at the US Army Kwajalein Atoll (USAKA)/Reagan Test Site (RTS) in the Republic of the Marshall Islands (RMI). This Environmental Assessment (EA) documents the results of a study of the potential environmental effects resulting from the flight test.

In support of SMC/XR, the SMC Environmental Management Branch of Acquisition Civil/Environmental Engineering determined that an EA is required to assess the potential environmental effects from the launch preparations, flight test, and post-test activities associated with the CSM Demonstration. This EA was prepared in accordance with the following regulations, statutes, and standards:

- National Environmental Policy Act (NEPA, 1969)
- Executive Order 12114 (*Environmental Effects Abroad of Major Federal Actions*) (Office of the President, 1979)
- The President's Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508) (CEQ, 2009)
- *Environmental Impact Analysis Process* (32 CFR Part 989) (US Air Force [USAF], 2009a)
- *Environmental Standards and Procedures for United States Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands*, 11th Edition (US Army

### **The Purpose of an Environmental Assessment**

An Environmental Assessment (EA) is prepared by a Federal agency to determine whether an action it is proposing would significantly affect any portion of the environment.

The intent of an EA is to provide project planners and Federal decision-makers with relevant information on the impacts that a proposed action might have on the human and natural environments.

If the study finds no significant impacts, then the agency shall record the results of that study in an EA and publish a Finding of No Significant Impact (FONSI). The agency may then proceed with the action.

However, if the results of the EA indicate that there would be potentially significant impacts associated with the action, then the agency must issue a Notice of Intent and prepare an Environmental Impact Statement (EIS).



Space and Missile Defense Command/Army Forces Strategic Command [USASMDC/ARSTRAT], 2009), hereafter referred to as the USAKA Environmental Standards or UES

- The Compact of Free Association, as Amended, between the Government of the United States of America and the Government of the Republic of the Marshall Islands, signed into law by President George W. Bush, December 17, 2003 (48 United States Code [USC] 1921).

## **1.2 BACKGROUND**

The CSM concept represents the AFSPC vision for supporting US Strategic Command (USSTRATCOM) in its CPGS mission. CSM is a ground launched, space traversing weapon system capable of transporting conventional (non-nuclear) payloads at intercontinental ranges. CSM offers the capability to strike globally, precisely, and apply force with desired effects.

This SMC/XR-led CSM Demonstration project represents the first step in the development and future acquisition of a CSM system. It is important to note that the CSM Demonstration would benefit from the ability to leverage from related efforts—specifically the Defense Advanced Research Projects Agency (DARPA) Hypersonic Technology Vehicle 2 (HTV-2) program, which was previously analyzed in the EA for HTV-2 Flight Tests (USAF, 2009b) and has two flight tests planned in calendar year (CY) 2010. The CSM Demonstration system would utilize an HTV-2 derived PDV with an integrated particle dispersion payload. The PDV would be launched on a Minotaur IV Lite booster system; the same configuration as used for the HTV-2 flight tests.

## **1.3 PURPOSE OF THE PROPOSED ACTION**

The purpose of the CSM Demonstration flight test is to demonstrate CPGS capabilities using combined hypersonic glide technologies. Through the application of these technologies, the flight test would demonstrate long-range, non-ballistic flight, and precision strike capability.

## **1.4 NEED FOR THE PROPOSED ACTION**

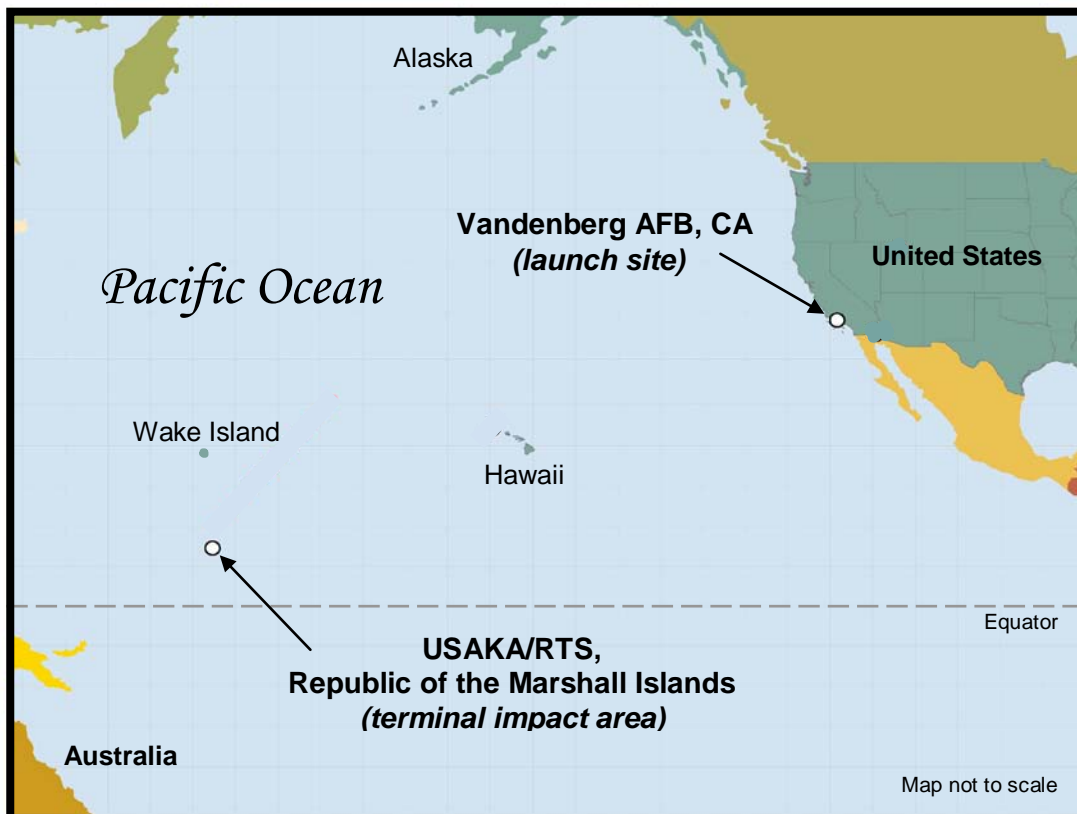
The US currently conducts strikes on foreign threats with conventional weapons primarily through the use of forward-based systems (e.g., tactical aircraft, cruise missiles, unmanned aerial vehicles, and heavy bombers). Effective use of these systems requires: (1) that there be adequate time to pre-position the aircraft and/or missiles within range of the targets; (2) minimal risk from local air defenses; and (3) when needed, availability of extensive mission-support assets (e.g., forward deployed ships and aircraft refueling tankers).

CPGS capabilities would give the United States the ability to attack targets thousands of miles away with precision-guided, non-nuclear payloads. The USAF's proposed CSM Demonstration flight test is part of the incremental development and demonstration of potential CPGS systems, and it represents just one of several delivery system test beds being considered by the Department of Defense (DoD) for future fielding. Such tests are needed to validate guidance and control requirements, and overall system performance.

## **1.5 SCOPE OF THE ENVIRONMENTAL ASSESSMENT**

This EA documents the environmental analysis of conducting a single CSM Demonstration flight test. As a rocket payload, the PDV would be launched from Vandenberg AFB using a Minotaur IV Lite booster.

Following launch over the Pacific Ocean, the PDV would separate from the booster and glide at hypersonic velocities in the upper atmosphere towards the USAKA/RTS in the RMI. Figure 1-1 shows the geographic locations of these sites. Upon reaching the terminal end of the flight, the vehicle would impact at one of two pre-designated, alternative locations downrange: (1) a land impact site on Illeginni Islet at the USAKA/RTS or (2) a floating platform placed in the Broad Ocean Area (BOA) north of USAKA/RTS. Although subject to change, the USAF plans to conduct the flight test in the late CY 2012 timeframe.



**Figure 1-1. Locations for Proposed CSM Demonstration Flight Test**

The EA analyzes the potential environmental effects that might result from pre-flight preparations, flight testing, land and ocean impacts, and post-test activities associated with the CSM Demonstration. To conduct the flight test, existing support buildings and facilities would be used with limited modifications required.

In accordance with the CEQ and USAF regulations for implementing NEPA (40 CFR 1502.14(d) and 32 CFR 989.8(d), respectively), this EA also analyzes the No Action Alternative that serves as the baseline from which to compare the Proposed Action. Under the No Action Alternative, the CSM Demonstration flight test would not occur.

## 1.6 RELATED ENVIRONMENTAL DOCUMENTATION

The SMC Environmental Management Branch of Acquisition Civil/Environmental Engineering relied heavily on existing NEPA documents to prepare this EA. These documents are listed in the following and cited in the EA where applicable:

- *Final Environmental Assessment for Minuteman III Modification* (USAF, 2004), hereafter referred to as the MM-III EA
- *Final Environmental Assessment for the Orbital/Sub-Orbital Program* (USAF, 2006), hereafter referred to as the OSP EA
- *Final Environmental Assessment for Hypersonic Technology Vehicle 2 Flight Tests* (USAF, 2009b), hereafter referred to as the HTV-2 EA.

## 1.7 DECISIONS TO BE MADE

Supported by the information and environmental analysis presented in this EA, the USAF will decide whether to conduct the CSM Demonstration flight test or to select the No Action Alternative. If the USAF decides to conduct the CSM Demonstration, it will also decide on which of the two downrange alternatives to select.

## 1.8 INTERAGENCY COORDINATION AND CONSULTATIONS

Interagency coordination was integral to the preparation of this EA. For the analysis effort, the USAF requested support from the USASMDC/ARSTRAT as a cooperating agency because of the potential for CSM Demonstration flight test activities to adversely affect biological and other environmental resources at USAKA/RTS. Written correspondence from the USASMDC/ARSTRAT regarding this agreement is provided in Appendix A, page A-2.

Because the proposed CSM Demonstration pre-launch preparations and launch activities at Vandenberg AFB have the potential to adversely affect Federally listed threatened and endangered species, base biologists prepared a Biological Assessment (BA) to evaluate the potential for impacts on the endangered El Segundo blue butterfly (ESBB) and the threatened California red-legged frog (VAFB, 2009b). In October 2009, Vandenberg AFB submitted the BA to the USFWS and requested formal consultation in accordance with Section 7 of the Endangered Species Act of 1973, as amended. In response, the USFWS provided the USAF a Biological Opinion (BO) on the effects of the Proposed Action on the ESBB and California red-legged frog at Vandenberg AFB, the findings of which are discussed in Section 4.1.1.3 of this EA. A complete copy of the USFWS BO is provided in Appendix D.

In March/April 2008, the Vandenberg AFB Cultural Resources Office conducted a National Historic Preservation Act Section 106 consultation with the California State Historic Preservation Officer (SHPO) for reuse of the TP-01 launch facility in support of the Missile Defense Agency (MDA) Kinetic Energy Interceptor (KEI) program (MDA, 2009). The consultation completed for the KEI program determined that there would be No Adverse Effect from site modifications and launch operations at TP-01. The reuse of TP-01 proposed in this EA for the CSM Demonstration is similar to that described in the prior KEI consultation. Therefore, the base Cultural Resources Office does not anticipate the need to re-engage in consultations with the SHPO for the CSM Demonstration.

In December 2009, the Vandenberg AFB Cultural Resources Office initiated Section 106 consultations with the Santa Ynez Band of Chumash Indians. Following a visit to the TP-01 launch site by a Chumash representative in late March 2010, the Elders Council was briefed on the findings and members concurred that the proposed CSM Demonstration activities would not affect cultural resources on base (refer to Appendix A, page A-6).

For compliance with Federal Coastal Zone Consistency regulations (15 CFR Part 930) and the California Coastal Zone Management Program, the SMC prepared a Negative Determination to address CSM-related actions at Vandenberg AFB. With the assistance of base personnel, the SMC submitted a Negative Determination letter to the California Coastal Commission (CCC) in October 2009 for their review and concurrence. In a letter dated December 7, 2009, the CCC agreed that the Proposed Action would not adversely affect coastal resources and, therefore, concurs with the Negative Determination (refer to Appendix A, page A-4).

Beginning in April 2009, the USAF entered into pre-consultation discussions with the Pacific Islands Regional Offices of the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS), both located in Honolulu, Hawaii. Pursuant to the requirements of the USAKA Environmental Standards, the USAF (with USASMDC/ARSTRAT support) held meetings and teleconferences with the agencies to discuss the potential for environmental effects from the proposed CSM Demonstration flight test activities along the over-ocean flight corridor and at USAKA/RTS. The discussions also served to identify possible mitigation measures to minimize the effects on biological resources.

In June 2009, the USAF (with USASMDC/ARSTRAT support) initiated consultations with the NMFS (Pacific Islands Regional Office), as required by the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.) and Section 3-4.5.3 (Consultation Procedures for Endangered and Threatened Resources) of the UES (USASMDC/ARSTRAT, 2009), because of potential effects on threatened and endangered species, and their habitats, in international waters and within the RMI. A biological assessment, in the form of a Coordinating Draft EA, was submitted to the NMFS for its review. In an October 2009 letter to the NMFS, the USAF updated its request for consultations because of potential debris impacts at Illeginni Islet on ESA-listed green and hawksbill sea turtles, and on three species of mollusks protected by RMI statutes. An updated version of the biological assessment, in the form of a revised Coordinating Draft EA, was included with the request. In a response letter to the USAF dated March 29, 2010, the NMFS concurred with the USAF's determination that conducting a single CSM Demonstration flight test from Vandenberg AFB to USAKA/RTS is not likely to adversely affect marine species or critical habitats protected under the ESA and RMI statutes. Findings on specific issues are detailed in the letter, provided in Appendix E of this EA, and are also discussed in Sections 4.1.2.2 and 4.1.3.3.

Also in June 2009, the USAF (with USASMDC/ARSTRAT support) initiated consultations with the USFWS (Pacific Islands Fish and Wildlife Office), as required by the ESA and UES, because of potential effects on green sea turtle nesting habitat at USAKA/RTS. A biological assessment, in the form of a Coordinating Draft EA, was submitted to the USFWS for its review. In an October 2009 letter to the USFWS, the USAF updated its request for consultations because of potential debris impacts at Illeginni Islet on ESA-listed green and hawksbill sea turtles, and sea turtle nesting habitat. An updated version of the biological assessment, in the form of a revised Coordinating Draft EA, was included with the request. In response, the USFWS provided the USAF a BO on the effects of the Proposed Action on green and hawksbill sea turtles at Illeginni Islet, the findings of which are discussed in Section 4.1.3.3 of this EA. A complete copy of the USFWS BO is provided in Appendix F.

Through interagency coordination, the USAF has also determined that the proposed CSM Demonstration flight test activities at USAKA will require a Document of Environmental Protection (DEP) in accordance

with Section 2-17.3 of the UES (USASMDC/ARSTRAT, 2009) because of potential impacts on biological resources. Separate from the NEPA process under which this EA is being prepared, the DEP process serves to provide a structured forum for USAKA, US Government agencies, the RMI Environmental Protection Authority (RMIEPA), and the general public to review and comment on proposed US activities that have the potential to affect the USAKA environment. At the completion of the process, appropriate agencies will sign the DEP to indicate agreement with the proposed activity, requirements, and limitations. In support of the USAF, the USASMDC/ARSTRAT formally initiated the DEP process in November 2009 by submitting a Notice of Proposed Activity to the USFWS, NMFS, US Environmental Protection Agency (USEPA) Region IX, US Army Corps of Engineers, and the RMIEPA. Completion of the DEP process is expected by early CY 2011, following public review and comment on the Draft DEP.

## 1.9 PUBLIC NOTIFICATION AND REVIEW

In accordance with the CEQ (2009) and USAF (2009a) regulations for implementing NEPA, the USAF solicited comments on the Draft EA from interested and affected parties. A Notice of Availability for the Draft EA, and the enclosed Draft FONSI, was published in local newspapers for both Vandenberg AFB and USAKA/RTS (see Table 1-1), announcing a 30-day review and comment period that ended on July 26, 2010. Because of an inadvertent failure of the *Kwajalein Hourglass* to publish the availability notice on schedule, the notice was published at a later date and the residents of USAKA/RTS were provided an extended review period that ended on August 2, 2010.

**Table 1-1. Newspaper Publications for the Notice of Availability**

Country or State	City/Town	Newspaper	Publication Dates
California	Santa Barbara	<i>Santa Barbara News-Press</i>	June 24, 25, & 27, 2010
	Santa Maria	<i>Lompoc Record</i>	June 24, 25, & 27, 2010
		<i>Santa Maria Times</i>	June 24, 25, & 27, 2010
Republic of the Marshall Islands	Majuro	<i>Marshall Islands Journal</i>	June 25, 2010
	USAKA/RTS	<i>Kwajalein Hourglass</i>	July 17, 2010

Copies of the Draft EA/Draft FONSI were placed in local libraries and were available over the Internet at <http://www.csm-ea.com>. A list of agencies, organizations, and libraries that were sent copies of the document is provided in Chapter 8.0.

Following the public review period (as specified in the newspaper notices and on the Internet), the USAF received no public comments. One agency, however, responded with comments on proposed activities at USAKA/RTS. Appendix G of this Final EA contains a reproduction of the agency's comment letter and the USAF's responses to their comments. A copy of the Final EA and the enclosed signed FONSI has been sent to those agencies, organizations, and individuals who specifically requested a copy of the final documents. The Final EA and signed FONSI are also available over the Internet at <http://www.csm-ea.com> for a limited time.

## 2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Within this chapter, Section 2.1 provides a description of the Proposed Action, including the Minotaur IV Lite booster, the PDV test vehicle, the launch site, flight test scenario, and two alternatives for conducting terminal phase activities. Section 2.2 provides a description of the No Action Alternative. Alternatives to the Proposed Action that were considered and eliminated from further study are discussed in Section 2.3. A summary comparison of the environmental consequences associated with the Proposed Action and the alternative actions is presented in Section 2.4. Finally, identification of the Preferred Action is presented in Section 2.5.

### 2.1 PROPOSED ACTION

#### 2.1.1 FLIGHT VEHICLE DESCRIPTION

For the CSM Demonstration, the test vehicle payload would be launched from Vandenberg AFB into the upper atmosphere on a Minotaur IV Lite booster. Descriptions of both the booster and PDV are presented in the sections that follow.

##### 2.1.1.1 Minotaur IV Lite

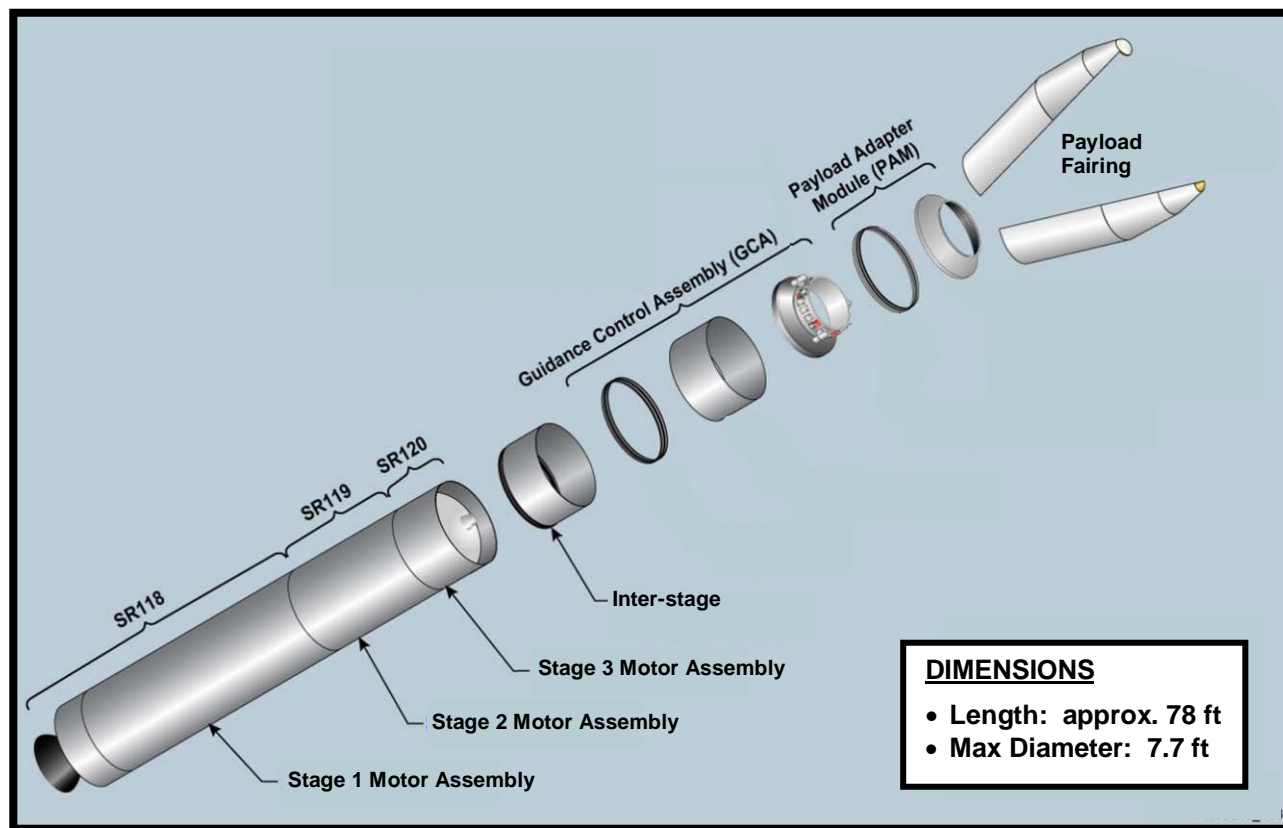
The Minotaur IV Lite is a modified intercontinental ballistic missile (ICBM) that uses the first three solid propellant stages from a deactivated Peacekeeper ICBM. Unlike the full Minotaur IV vehicle, the “Lite” version does not have a fourth-stage rocket motor. The USAF maintains the excess ICBM assets to provide Research, Development, and Test and Evaluation (RDT&E) launch vehicle support to the DoD and other US Government agencies. Because of its ICBM heritage, the Peacekeeper booster is subject to the provisions of the Strategic Arms Reduction Treaty I (START I) between the US, Russia, Belorussia, Kazakhstan, and the Ukraine (US Department of State, 1991).

The Minotaur IV Lite consists of three main vehicle sections: a Government Furnished Equipment (GFE) 3-stage solid-propellant booster, Guidance and Control Assembly (GCA), and Payload Assembly. The overall vehicle length is approximately 78 feet (ft) (23.8 meters [m]), with a maximum diameter of 7.7 ft (2.3 m) and a weight of approximately 195,000 pounds (lb) (88,400 kilograms [kg]), not including the mass of the PDV. A diagram of the Minotaur IV Lite booster vehicle is provided in Figure 2-1.

The Minotaur IV Lite booster includes a total of approximately 168,000 lb (76,200 kg) of solid propellant in its three rocket motors: SR-118 (Stage 1), SR-119 (Stage 2), and SR-120 (Stage 3). Other ordnance carried onboard includes motor igniter assemblies, linear explosive assemblies for stage separation, and an ordnance destruct package that initiates a thrust termination action if a launch anomaly occurs. The motors and other ordnance would be handled in accordance with DoD 6055.09-STD (*DoD Ammunition and Explosives Safety Standards*) to avoid accidental activation and limit risks of injury to humans and the environment. The DoD/US Department of Transportation (DOT) explosive classification and division determines the method by which the rocket propellants and other ordnance are shipped and stored.<sup>1</sup> The individual Minotaur IV Lite rocket motors have a hazard classification/division of 1.3 or 1.1, but when

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<sup>1</sup> US DOT regulations (49 CFR 173.56(b)(2)(i)) require the DOD to hazard classify items in accordance with Joint Technical Bulletin (TB) TB-700-2, *Department of Defense Ammunition and Explosives Hazard Classification Procedures*. TB-700-2 sets



**Figure 2-1. Minotaur IV Lite Vehicle**

the motors are present together—such as when storing, transporting, or stacking stages prior to launch—the combined explosives rating is 1.1. Under such circumstances, the combined motors are treated accordingly per DoD 6055.9-STD to limit risks and decrease the chance of unintended catastrophic detonation.

During powered flight, each rocket motor uses a Thrust Vector Control (TVC) system (steering mechanism) for pitch and yaw control. Up to several gallons of hydraulic fluid are contained in each motor TVC system. To provide electrical power for the Minotaur IV Lite, eight nickel-cadmium batteries are carried in the GCA. The battery weights range from 3 to 12 lb (1.4 to 5.4 kg) each.

Launches of the Minotaur IV Lite booster from Vandenberg AFB were previously analyzed in the HTV-2 and OSP EAs. Analysis findings presented in the documents identified no significant environmental effects from launching Minotaur IV Lite or other Peacekeeper-derived vehicles from Vandenberg AFB.

#### **2.1.1.2 Payload Delivery Vehicle**

Similar to the HTV-2 vehicle (USAF, 2009b), the PDV represents a test bed to demonstrate the use of hypersonic technology to deliver a variety of effects at vast distances. The vehicle would be designed to fit inside of the Minotaur IV Lite Payload Assembly (fairing), and its mass at launch would be well-

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forth the detailed procedures for hazard classifying ammunition and explosives for transportation and storage in accordance with US DOT regulations, North Atlantic Treaty Organization guidelines, and United Nations recommendations.

within the payload capability of the Minotaur IV Lite booster. The standard Payload Assembly measures approximately 20 ft (6.1 m) in length, with a maximum diameter of 7.7 ft (2.3 m). Maximum payload mass capability for the Minotaur IV Lite, including separation hardware, is approximately 3200 lb (1452 kg), depending on individual mission requirements. Figure 2-2 shows the basic shape of the PDV and Table 2-1 lists the vehicle's key system characteristics, including the integrated particle dispersion payload.



**Figure 2-2. Payload Delivery Vehicle**

<b>Table 2-1. PDV System Characteristics</b>	
Structure	Aluminum, titanium, steel, tantalum, tungsten, carbon fabric, silica, and other alloys that include approximately 0.35 ounces (10 grams [g]) of beryllium (Be), 4.0 lb (1.8 kg) of chromium (Cr), and 10.3 lb (4.7 kg) of nickel (Ni)
Communications	Various 5 to 20 Watt (radio frequency) transmitters; maximum 900 Watt radio frequency pulse
Power	Up to five lithium ion and lithium thionyl chloride batteries, each weighing between 1 and 30 lb (0.5 and 13.6 kg)
Propulsion	Approximately 3 lb (1.4 kg) of pressurized nitrogen gas
Particle Dispersion Payload	Approximately 850 lb (386 kg) total weapon weight, including 150 to 200 lb (68 to 91 kg) of high explosives and several thousand debris particles, each measuring no more than a few centimeters (cm) in diameter
Other	Ten small Class C (1.4) electro-explosive devices for mechanical systems operation

As indicated in Table 2-1, hazardous materials used in the PDV would consist of small quantities of potentially toxic metals, batteries, and several explosive devices. No solid or liquid propellants, or radioactive materials, would be carried in the vehicle. Each battery would be environmentally qualified, including safeguards for containing accidental hazardous battery casing leakage or electrical anode/cathode shorting. The nitrogen gas-filled tank would have adequate safety factors for proof and burst pressures in accordance with MIL-STD-1411A (*Inspection and Maintenance of Compressed Gas Cylinders*). All explosive devices would be handled in accordance with DoD 6055.09-STD.



## 2.1.2 DEMONSTRATION FLIGHT TEST

For the CSM Demonstration flight test, this section describes: (1) the launch preparations and operations to occur at Vandenberg AFB; (2) the PDV flight test scenario over the Pacific Ocean; and (3) the terminal phase preparations and operations to occur on Illeginni Islet or in the BOA at USAKA/RTS.

### 2.1.2.1 Launch Site Preparations and Operations

Vandenberg AFB is the headquarters of the 30th Space Wing, which conducts space and missile test launches, and operates the Western Range.<sup>2</sup> The base hosts a variety of Federal agencies and commercial aerospace companies. In support of the CSM Demonstration flight test at Vandenberg, several existing facilities would be used, which are listed in Table 2-2 and shown on Figure 2-3. All of the facilities were previously analyzed for Minotaur IV Lite and other Peacekeeper-derived missions as part of program planning for the HTV-2 and/or OSP Programs (USAF, 2006; 2009b).

<b>Table 2-2. List of Facilities Proposed to Support the CSM Demonstration at Vandenberg AFB, CA</b>			
<b>Facility / Building</b>	<b>Planned Function</b>	<b>Site Modifications and Construction</b>	<b>Prior Minotaur IV Lite Program Planning</b>
Test Pad-01 (TP-01) (Bldg 1840)	Launch Site	Modifications to launch pad and infrastructure	OSP
Integration Refurbishment Facility (IRF) (Building 1900)	Booster Processing	None	OSP, HTV-2
Integrated Processing Facility (Building 1806)	Payload Processing (Alternatives)	Little or no modifications expected	OSP
Experimental Payload Facility (Building 6527)			OSP
Payload Assembly Building (Building 8415)			OSP
Remote Launch Control Center (Building 8510)	Launch Control	None	HTV-2

#### 2.1.2.1.1 Site Modifications

The TP-01 launch pad is the only facility that would require any modifications or construction. Because of the launch pad's disuse for many years, various repairs, site upgrades, and other modifications are necessary in order for the site to support the CSM Demonstration launch.<sup>3</sup> Proposed modifications and

<sup>2</sup> The Western Range extends from the CA Coast to the Indian Ocean and consists of a vast array of space and missile tracking and data gathering equipment. Up-range instrumentation sites are located on Vandenberg AFB, Pillar Point Air Force Station, Anderson Peak, and Santa Ynez Peak. Midrange instrumentation is located on the Hawaiian Islands. Western Range instrumentation is supplemented by Point Mugu Naval Air Warfare Center in CA, the USAKA/RTS, and US Air Force Maui Optical Site in Hawaii.

<sup>3</sup> The USAF originally constructed TP-01 in 1982. Between 1983 and 1985, the USAF conducted eight Peacekeeper ICBM test launches from TP-01. The pad was last used for Small ICBM test launches in 1989 and 1991.

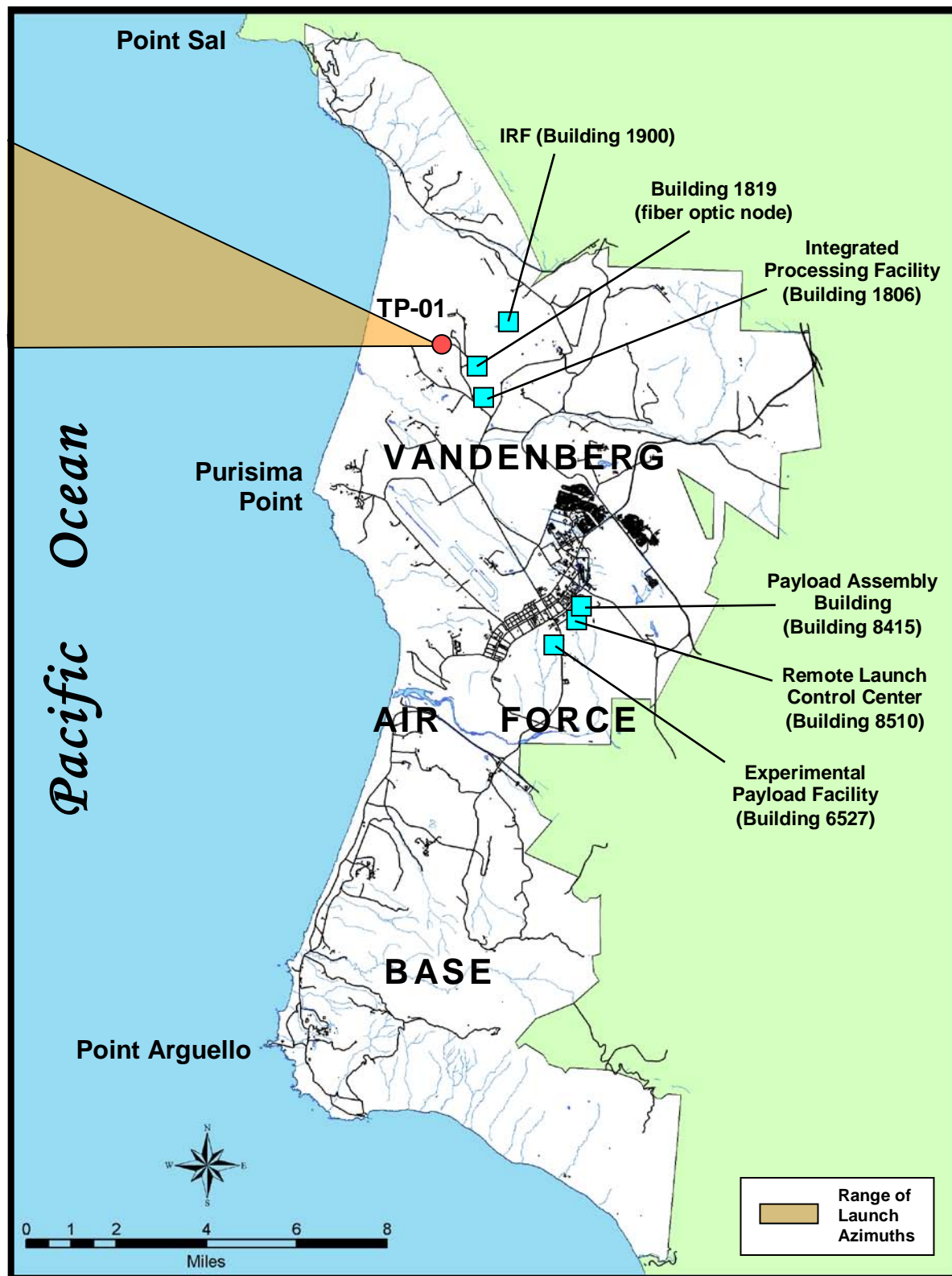


Figure 2-3. Facilities Proposed to Support the CSM Demonstration at Vandenberg AFB, CA

construction requirements for TP-01 are listed below. Facility modifications would begin in mid-CY 2010 at the earliest and take up to several months to complete.

- Realign perimeter chain link fence across the east end of the launch pad, including installation of a new gate entrance.
- Restore electrical power to the launch pad via existing power poles and underground conduits, and install a 480 kilovolt transformer on the existing concrete pad next to the launch pad.
- Install copper communication lines to TP-01 via existing poles and underground conduits.
- New electrical grounding points would need to be installed in or immediately adjacent to the launch pad.
- Construct an approximate 44-ft (13-m) long by 44-ft (13-m) wide by 105-ft (32-m) tall mobile scaffolding (gantry) with an environmental enclosure for the launch vehicle and workers. Scaffolding mobility would require the installation of four rails and up to 16 tie-down concrete mounting pads (approximately 12 by 15 inches [30 by 38 cm]) in the existing launch pad area for securing the scaffolding in both the stowed and service positions.
- Install a 23 ft (7 m) tall launch stand, which would require four new concrete mounting pads (approximately 28 by 28 inches [71 by 71 cm]) in the existing launch pad area.
- Install rocket motor Break-Over Fixture and Extension Rail Structure, which would require 10 new concrete mounting pads (approximately 12 by 15 inches [30 by 38 cm]) in the existing launch pad area.
- Install four concrete pads (approximately 12 by 15 inches [30 by 38 cm]) in the existing launch pad area for the Type II Transporter.
- Install two tie-down anchors along the north and south edges of the existing launch pad for the umbilical tower guy wires.
- Modifications to the TP-01 underground Launch Equipment Building (LEB) may include:
  - Remove and dispose of 30 lead acid and 24 lead calcium batteries from prior uninterruptible power supply (UPS) and install new UPS batteries, if necessary
  - Install electronic launch support equipment
  - Install air handler and/or air quality monitoring system
  - Replace electrical systems and lights.
- Install new exterior lighting on existing poles around the launch pad.
- Install one or two closed circuit television cameras and film cameras on a new or existing pole adjacent to the launch pad.
- Install area warning lights and an alert horn on an existing pole off the east end of the launch pad.
- If needed, install an L-band radio frequency re-radiation tower just east of the launch pad.

- Reestablish a vegetation clear zone/firebreak around the TP-01 launch pad by cutting back and mowing vegetation inside the existing pad fence line, and 20 ft (6 m) outside of the fence line, for a total of approximately 1.5 acres (0.6 hectares) to be cleared.
- Create a second firebreak southeast of TP-01 by cutting back and mowing vegetation from the end of the Rhea Road turn-around to the existing railroad track—an area which would measure 275 ft (84 m) long and 30 ft (9 m) wide for a total of approximately 0.2 acres (0.1 hectares) to be cleared.
- Install new fiber optic cable from TP-01 to the fiber optic node at Building 1819, which would require excavating a shallow trench (about 12 in [30 cm] deep and 9 in [23 cm] wide) for approximately 4,900 ft (1,494 m) along Rhea Road. Trenching would occur within 5 ft (1.5 m) of the road shoulder and require boring underneath three roadway crossings.
- During construction and launch operations, temporarily place the following facilities east of the launch pad on existing pavement or gravel.
  - 40 ft (12 m) long modular unit for a break room and equipment storage
  - Portable guard shack
  - Portable toilets
  - Small potable water trailer (water buffalo).

Construction activities would require use of heavy equipment and pneumatic tools, including mobile diesel-powered cranes, heavy trucks, backhoe, forklifts, trencher, boring machine, and air compressors. Heavy equipment would remain on the TP-01 launch pad or on other paved areas when operating around the pad area. Construction staging areas also would be located on existing paved areas to the east of the launch pad. Soil excavation would be limited to one new tower and/or pole off the east end of TP-01 and trenching along Rhea Road for the new fiber optic cable.

#### **2.1.2.1.2 Pre-Launch Preparations**

At Hill AFB, Utah, the three Minotaur IV Lite rocket motor stages (SR-118, SR-119, and SR-120) would be removed from storage, and inspected and tested for flight worthiness prior to shipment to Vandenberg AFB. Each stage would be individually shipped to Vandenberg AFB by truck using specialized equipment to handle the heavy motors. All transportation, handling, and storage of the rocket motors and other ordnance would occur in accordance with DoD, USAF, and US Department of Transportation policies and regulations to safeguard the materials from fire or other mishap. Shipment of the rocket motors to Vandenberg AFB was previously analyzed in both the HTV-2 and OSP EAs. Because the analyses identified no significant impacts to the human or natural environments, the shipment of motors is not analyzed further in this EA.

Upon arrival at Vandenberg AFB, each motor would be inspected and offloaded at the IRF (Building 1900) using overhead cranes to initiate motor/booster processing. As part of booster integration and systems testing, contractors would add Flight Termination System (FTS) charge assemblies to each motor. The purpose of the FTS is to terminate motor thrust if unsafe conditions develop during powered flight.

The PDV, particle dispersion payload, and GCA would arrive separately at Vandenberg AFB via truck or aircraft, and then be transported to one of the alternative Payload Processing Facilities (PPF). At the PPF, personnel would conduct final vehicle assembly and various system/subsystem tests. These actions would include installation of the payload into the PDV, attaching the PDV to the Payload Adapter

Module, and encapsulating the vehicle in the Payload Fairing (see Figure 2-1) to form the Payload Assembly.

Following booster processing and integration tests, the rocket motors would be transported individually to TP-01. At the pad, each motor would be rolled horizontally onto the Break-Over Fixture. A diesel powered mobile crane would be used to rotate the motor about the Break-Over Fixture into a vertical position. The crane would then stack each motor onto the launch stand one at a time. The GCA and Payload Assembly containing the PDV would be transported separately to the launch pad and installed on the completed booster stack. Prior to transporting the Payload Assembly, personnel would conduct a route survey from the PPF to TP-01 to ensure road surfaces and overhead wire clearances are adequate.

At TP-01, the mobile scaffolding would provide worker access to each stage level, and environmental protection for workers and the launch vehicle. One or two portable electric thermal conditioning units (air conditioners) would supply air for the environmental enclosure and payload.

In addition to the propellants, ordnance, and batteries used in the launch vehicle, processing and integration activities for the booster and PDV would require the use of small quantities of lubricants, paints, sealants, and solvents (less than 10 lb [4.5 kg]). Use of all hazardous materials would comply with applicable Vandenberg AFB hazardous materials management requirements.

Electrical power for operations would come from existing commercial power. A portable diesel generator (rated at approximately 250 kilowatts [kW] and 400 horsepower) would be available at TP-01 for backup power only. The generator would be provided by the launch contractor and permitted by the Santa Barbara County Air Pollution Control District or registered under the California Air Resources Board's Portable Equipment Registration Program.

In preparation for pre-launch activities at Vandenberg AFB, the USAF would develop operational procedures detailing safety requirements for all test personnel and contractors involved in the CSM Demonstration.

#### **2.1.2.1.3      *Launch Activities***

On the day of launch, final vehicle closeout and appropriate arming operations are performed. At TP-01, the mobile scaffolding would be rolled back in preparation for countdown and launch. Launch would occur along a predetermined azimuth ranging from 270 to 295 degrees (see Figure 2-3). Launch operations would be conducted from the Remote Launch Control Center (Building 8510).

Prior to conducting the launch, USAF personnel would conduct a comprehensive safety analysis to determine specific launch and flight hazards. A standard dispersion computer model, run by installation safety personnel, would be used for both normal and aborted launch scenarios. As part of this analysis, risks to off-base areas and non-participating aircraft, sea vessels, and personnel are determined. The results of this analysis are then used to identify the launch hazard area, expended booster drop zones, and a terminal hazard area for shroud components. A flight termination boundary along the vehicle flight path is also predetermined in case a launch vehicle malfunction or flight termination action occurs. The flight termination boundary defines the limits at which command flight termination would be initiated to contain the vehicle and its debris within predetermined hazard and warning areas, thus minimizing the risk to test support personnel and the public.

As a normal procedure, commercial and private aircraft, and watercraft, are notified of all the hazard areas several days prior to launch through a Notice to Airmen (NOTAM) and Notice to Mariners (NOTMAR). Within a day prior to launch, radar and other remote sensors are used to verify that the

hazard areas are clear of non-mission-essential aircraft, vessels, and personnel. Recreational areas in the vicinity would be closed—typically for less than a day. Commercial train movements through the base are also coordinated and monitored.

The USAF also notifies oilrig companies of an upcoming launch event several days in advance. The notification requests that offshore oilrigs temporarily suspend operations and evacuate or shelter their personnel if rigs are located in the path of the launch vehicle overflight.

If the launch vehicle were to head off course or should other problems occur during flight, then the Missile Flight Control Officer would activate the FTS on the vehicle. The signal to destruct is initiated by receipt of a radio command from the base. The destruct package also contains the logic to detect a premature separation of the booster stages and initiate a thrust termination action on its own. Thrust is terminated by initiation of an explosive charge that splits or vents the motor casing, which releases pressure and significantly reduces propellant combustion. This action would stop the booster's forward thrust, causing the launch vehicle to fall along a descending trajectory into the ocean. Other explosive charges located near the Payload Assembly would disable the PDV's ability to fly in case it separated from the booster prematurely.

#### **2.1.2.1.4 Post-Launch Operations**

The TP-01 pad area would be checked for safe access after vehicle liftoff from the launch pad. Post-launch activities would include inspection of the launch pad facilities and equipment for damage, as well as general cleanup and performance of maintenance and repairs. The launch stool, mobile scaffolding, and the Break-Over Fixture/Extension Rail Structure would be disassembled, removed from the pad, and placed in storage. The temporary structures and equipment, including the modular unit, guard shack, portable generator, and portable toilets, would also be removed from the TP-01 area. The expended rocket motors and other vehicle hardware would not be recovered from the ocean following flight.

#### **2.1.2.2 Flight Test Scenario**

Following motor ignition and liftoff from Vandenberg AFB, the Minotaur IV Lite 1st-stage motor would burn out and separate from the 2nd stage. Further into flight, the 2nd-stage and 3rd-stage motors would also burn out and separate. Splashdown of all three spent motor stages, and the fairing, would occur at different points in the open ocean between 100 and 1,500 nautical miles (nmi) (185 and 2,780 km) off the CA coast. Figure 2-4 shows a representative flight path and rocket drop zones for the CSM Demonstration mission launched from Vandenberg AFB towards USAKA/RTS in the Marshall Islands.

Jettison of the fairing and PDV separation would occur outside the atmosphere at an altitude of several hundred thousand feet. Following separation, the PDV would use autonomous flight control to maneuver and begin the hypersonic glide portion of the test flight between 150,000 and 250,000 ft (45,720 and 76,200 m) in altitude. The flight path would extend well north of the Hawaiian Islands; flying over a portion of the Northwestern Hawaiian Islands (NWHI). As the PDV nears USAKA/RTS (the terminal end of flight) at an altitude of about 100,000 ft (30,480 m), it would maneuver towards the pre-designated impact site at Illeginni Islet or in the BOA.

If a malfunction were to occur during PDV flight, the onboard FTS system would be activated. This action would prevent active steering control and initiate a predetermined safe mode for the vehicle, causing it to fall towards the ocean and terminate flight. No inhabited land areas would be subject to unacceptable risks of falling debris. Computer-monitored destruct lines, based on no-impact lines, are pre-programmed for the Flight Safety software to avoid any debris falling on inhabited areas, as per Space System Software Safety Engineering protocols and US range operation standards and practices. In

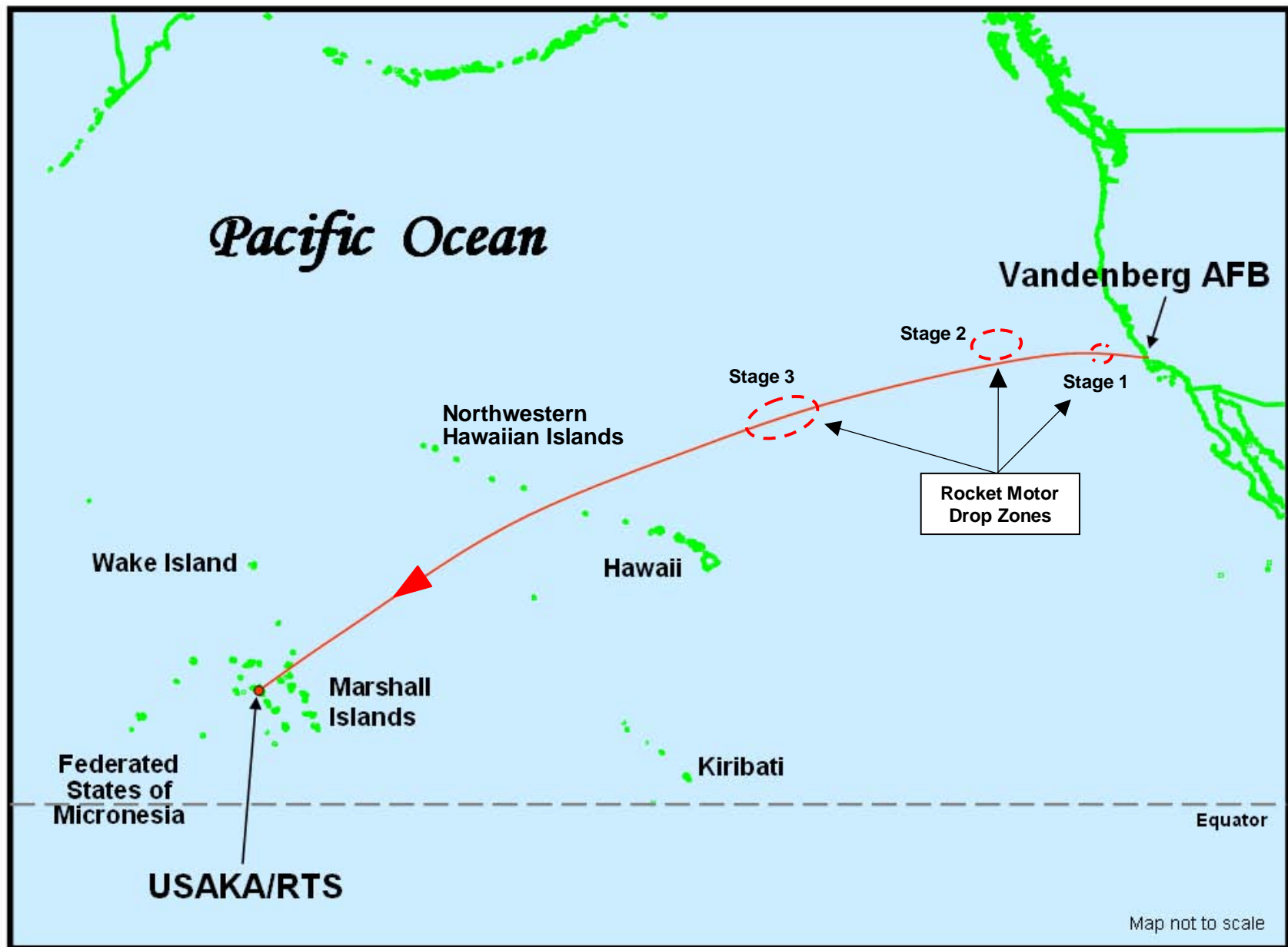


Figure 2-4. Representative Over-Ocean Flight Path for the CSM Demonstration

accordance with US range operation standards, the risk of casualty (probability for serious injury or death) from falling debris for an individual of the general public cannot exceed 1 in 1,000,000 during a single flight test or mission (Range Commanders Council [RCC], 2007).

### 2.1.2.3 Terminal Phase Preparations and Operations

For more than 16 years, the USAKA/RTS has been an impact area for hypersonic vehicles from ICBM and other flight tests launched from Vandenberg AFB. Vehicle impacts from such tests have occurred within the Kwajalein Atoll lagoon, on and in the vicinity of Illeginni Islet, and in the BOA near USAKA/RTS. These actions were previously analyzed in the following environmental documents:

- *Final Environmental Assessment for Hypersonic Technology Vehicle 2 Flight Tests* (USAF, 2009b)
- *Final Environmental Assessment for Minuteman III Modification* (USAF, 2004)
- *Final Supplemental Environmental Impact Statement for Proposed Actions at US Army Kwajalein Atoll* (US Army Space and Strategic Defense Command [USASSDC], 1993)
- *Environmental Assessment for Department of Energy (DOE) Reentry Vehicles, Flight Test Program, US Army Kwajalein Atoll, Republic of the Marshall Islands* (USAF, 1992).

Like many of the ICBM hypersonic vehicle tests, the proposed CSM Demonstration flight test would use Illeginni Islet for a land impact or impact in the BOA near USAKA/RTS (the same general area as for the HTV-2 flight tests). The USAF prefers a land impact at Illeginni because it provides a larger and relatively low-cost test environment, and allows the US Government to take advantage of existing infrastructure and instrumentation critical to evaluation of the CSM system. Impacting at Illeginni Islet, however, presents potential range safety concerns and environmental risks. Thus, the USAF also considered a floating platform to be placed in international waters of the BOA approximately 40 to 80 nmi (74 to 148 km) north of USAKA/RTS. Figure 2-5 shows the representative PDV flight paths for the Preferred (land impact) Alternative and the BOA Alternative.

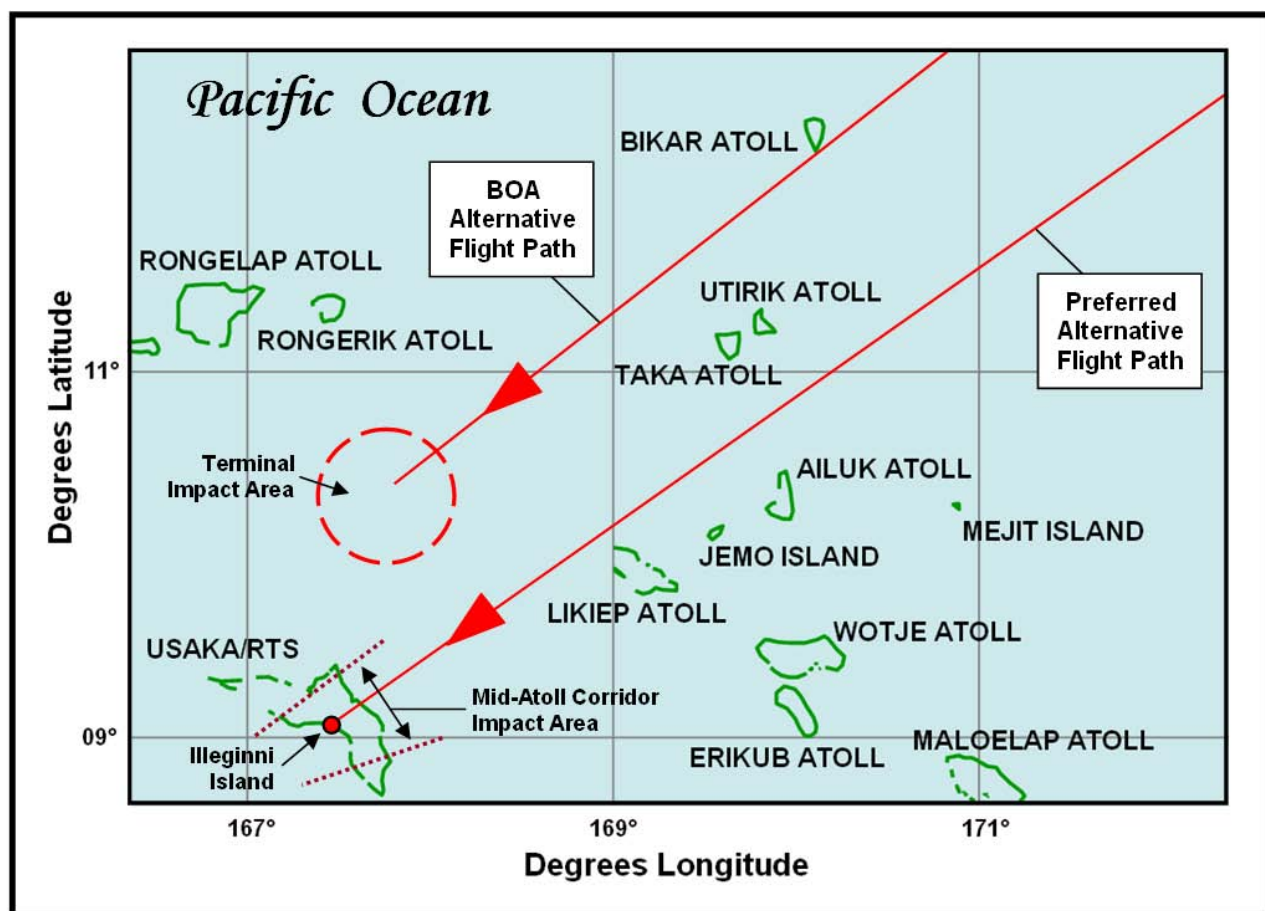
#### 2.1.2.3.1 Pre-Test Preparations and Support

##### Preferred (Land Impact) Alternative

In preparation for the CSM Demonstration land impact at USAKA/RTS, various test support equipment and materials would be shipped to the range for temporary placement on Illeginni Islet. The equipment and materials would first be transported to Kwajalein Islet (located on the southern tip of Kwajalein Atoll) on a ship and/or normally scheduled USAF flights. Prior to shipment from the US to USAKA/RTS, the equipment would be washed and a certified Pest Control Technician or Military Veterinarian would inspect the equipment to ensure that it does not contain any insects, animals, plants, or seeds. The washing and inspection process would help to prevent exotic species from being introduced into the RMI.

From Kwajalein Islet, the test support equipment and materials, and other range equipment, would be transported to Illeginni Islet on a barge and/or a Landing Craft Utility (LCU) vessel based at USAKA/RTS. Once at Illeginni Islet, personnel would unload the barge and/or vessel at the existing slip ramp located within the small harbor on the east side of the islet. The range equipment would likely include a diesel powered crane, truck, heavy-duty fork lift, portable cement mixer, backhoe/loader, and portable power generators.

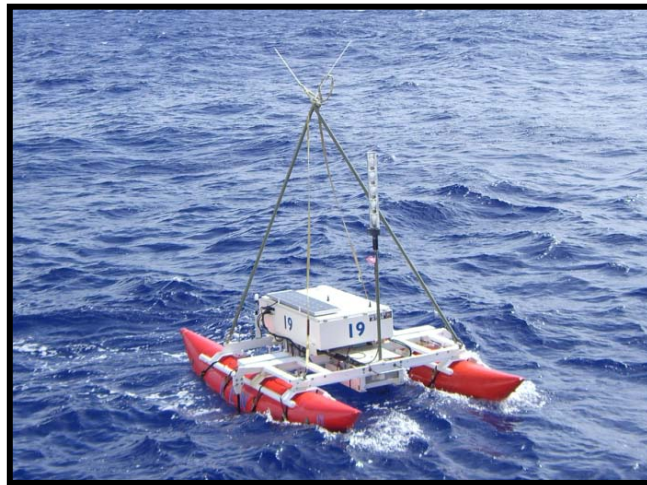




**Figure 2-5. Representative PDV Alternative Flight Paths in the Marshall Islands**

All of the equipment and materials would be moved along an existing road to the west side of the islet, which is mostly open and partially paved. Prior to the flight test, the test support equipment and materials would be temporarily laid out over a large portion of the open area—an area of about 2 acres (0.8 hectares) in size. Some of the support equipment would be erected to a height of approximately 40 ft (12 m). Shallow stakes and anchors would be placed into the ground, but generally there would be little or no soil excavation. Setup plans would incorporate design aspects to minimize the potential for payload particles or other PDV debris to ricochet beyond the intended impact area. In addition, none of the test support equipment and materials would contain propellants, ordnance, fuels, oils, pressurized gases, batteries, or other hazardous materials. A crew of up to 15 personnel would be periodically on the islet for this effort, which would take up to 30 days to complete. During this period, personnel would be transported daily from Kwajalein Islet to Illeginni via helicopter, and/or they would be housed on a ship temporarily docked/anchored at Illeginni. At the completion of the islet preparations and setup, all or most of the range equipment would be loaded back onto the barge or LCU and transported back to Kwajalein Islet. Pending potential launch delays for the CSM Demonstration flight test, the support equipment setup could remain in place on Illeginni Islet for up to 60 days.

Within days of the flight test, several portable camera stands would be set up around the western end of Illeginni Islet to record the flight test. In addition, approximately three free-floating rafts with onboard cameras and sensors (see Figure 2-6) would be temporarily placed in the lagoon and ocean waters within



Source: Yakuma, 2008

**Figure 2-6. Representative Sensor Raft System**

several hundred feet of the islet in waters no less than 10 ft (3 m) deep. Deployed from a barge or LCU, the rafts would either be anchored or would maintain position using onboard battery-powered electric motors.

In support of the flight test, the USAKA/RTS would operate an extensive array of missile tracking radars and sensors located on several of the Kwajalein Atoll islets. For the CSM Demonstration flight test, the range would provide telemetry, radar tracking, optical sensors, and other technical and logistical support. Existing personnel based at USAKA/RTS would provide most of the test support, including sensor operations. Other auxiliary land-based, sea-based, and/or airborne sensors may be involved in tracking the PDV and collecting data at various locations along the over-ocean flight corridor. These support assets may include US Navy aircraft based out of Hawaii and the US Army Vessel (USAV) Worthy based at USAKA/RTS. They would be operated in their normal capacity in support of the CSM Demonstration.

Because whales and other marine mammals may occasionally be found in the vicinity of Illeginni Islet, USAKA/RTS personnel would conduct a helicopter or fixed-wing aircraft overflight of the islet vicinity at least three times over the week prior to the flight test. The final overflight would be made as close to the proposed test launch time as safely practicable. If personnel observe marine mammals or sea turtles in the area, they would report such sightings to the USAKA Environmental Management Office, the RTS Range Directorate, and the Flight Test Operations Director at Vandenberg AFB.

### **BOA Alternative**

To implement the BOA Alternative, up to three oceangoing deck barges would be lashed together, side-by-side, to be used as an impact platform. The steel-hulled barges, each measure approximately 100 ft (31 m) wide and 300 ft (92 m) long, would be towed from Hawaii or from another location using an ocean tug. Prior to positioning the barges in the BOA for the flight test, the barges would be temporarily moored at USAKA/RTS. In preparation for the test, test support equipment and materials, similar to those used for the Preferred Alternative, would be set up on the barge decks. Within a day before the CSM Demonstration flight test, the tug would tow the barges into position within the BOA. The tug would then leave the general area until after the test. The barges' position in the BOA would be

maintained by an un-manned dynamic positioning system consisting of four diesel-powered outboard thrusters. Power for the thrusters would come from four deck-mounted hydraulic power units, each containing lead-acid marine batteries; approximately 38 gallons (143 liters) of diesel fuel; and several gallons of coolant, oil, and hydraulic fluid. Additional lead-acid or lithium batteries on the barges would power control systems and sensors. No other fuels, oils, propellants, ordnance, pressurized gases, or other hazards materials would be onboard the barges during the flight test.

Sensor support for the BOA Alternative would be similar to that previously analyzed in the HTV-2 EA (USAF, 2009b). The USAKA/RTS would provide telemetry, tracking, sensing, and other technical and logistical support. In addition to the fixed assets at USAKA/RTS, several mobile assets would also be used to support the flight tests. These assets might include the USAV Worthy and one or two of the USAKA/RTS-based LCU vessels, which could be fitted with sensors to track and collect telemetry data from the end of the PDV's glide through to impacting the ocean barges. To account for potential flight test delays, the barges and support vessels would remain in the BOA impact area for up to 10 days before returning to USAKA/RTS. If test delays were to occur, the hydraulic power units on the barges would likely require refueling.

In addition to the vessel support, up to 16 free-floating rafts with onboard optical and/or acoustical sensors and telemetry equipment (see Figure 2-6) may be placed in the vicinity of the ocean barges. Within a day of the flight test, one or two of the range LCUs would be used to deploy the rafts. The rafts would be equipped with battery-powered electric motors for propulsion to maintain position in the water. Sensors on the rafts would collect data during the PDV's descent until impact.

Existing personnel based at USAKA/RTS would provide most of the test support at the range and within the BOA, including vessel and sensor operations. Just as for the Preferred Alternative, other auxiliary land-based, sea-based, and/or aircraft-based sensors may be involved in tracking the PDV and collecting data at various locations along the over-ocean flight corridor. These existing systems would be operated in their normal capacity in support of the CSM Demonstration.

Whales or other marine mammals may occasionally swim within the vicinity of the BOA impact area. If ship personnel observe marine mammals or sea turtles during positioning of the ocean barges or during deployment of sensors, they would report such sightings to the USAKA Environmental Management Office, the RTS Range Directorate, and the Flight Test Operations Director at Vandenberg AFB. USAKA/RTS aircraft pilots operating in the vicinity of the impact and test support area would also report any opportunistic sightings of marine mammals and sea turtles.

#### **2.1.2.3.2      *Terminal Flight and Impact Activities***

##### **Preferred (Land Impact) Alternative**

During terminal flight over the Kwajalein lagoon, as the PDV approaches Illeginni Islet, the integrated payload would be activated. At a very low altitude just above the islet, the payload's high explosives package would detonate. This action would disperse the several thousand particles over the western end of Illeginni Islet. All or most of the particles are expected to hit the intended land impact area. Other PDV debris would also impact in this area.

To ensure the safe conduct of these types of flight tests, a Mid-Atoll Corridor Impact Area has been established across USAKA/RTS, as is shown on Figure 2-5. When a point of impact is planned to occur in this corridor, a number of strict precautions are taken to protect personnel and the general public. Such precautions may consist of evacuating nonessential personnel and sheltering all other personnel remaining within the Mid-Atoll Corridor. Just as at Vandenberg AFB, NOTAMs and NOTMARs are published and

circulated in accordance with established procedures to provide warning to personnel and inhabitants of the RMI, concerning any potential hazard areas that should be avoided. Radar and visual sweeps of hazard areas are accomplished immediately prior to such flight tests to assist in the clearance of non-critical personnel. Only mission-essential personnel are permitted in hazard areas.

### **BOA Alternative**

As the PDV approaches the ocean barges in the BOA, the integrated payload would be activated in the same manner as for the Preferred Alternative. At a very low altitude just above the barges' location, the payload's high explosives package would detonate. This action would disperse the several thousand particles over the intended barge area. The payload particles and other PDV debris would impact on the barges and in the ocean immediately adjacent to the barges.

To ensure the safe conduct of this type of flight test, the USAKA/RTS would implement standard range safety procedures. NOTAMs and NOTMARs would be published and circulated in accordance with established procedures to warn personnel and inhabitants of the RMI of potential hazard areas they should avoid. Radar sweeps of the hazard areas would be conducted immediately prior to the flight test to ensure that non-mission ships and aircraft are clear. Personnel on the CSM Demonstration mission-support vessels would also conduct visual surveys to help confirm that the test area is clear.

#### **2.1.2.3.3 Post-Test Operations**

### **Preferred (Land Impact) Alternative**

Following completion of the CSM Demonstration flight test, USAKA/RTS personnel would first secure Illeginni Islet and recover the free-floating sensor rafts. No on-islet assessment or cleanup activities would occur until: (1) Unexploded Ordnance (UXO) personnel from the range inspect the impact area, and (2) other personnel stabilize fugitive dust and disturbed soil by wetting/washing the site. Personnel working in the impact area would wear proper Personal Protective Equipment (PPE), as necessary. Only freshwater would be used to wet and/or wash the site, which would be transported to Illeginni on a barge, LCU, or other vessel. Once the site is cleared for safe entry, test support personnel would conduct an impact assessment of the site and begin recovery of all visible payload particles and other PDV debris. For the recovery of particles or other debris that penetrates the sandy soil, metal detectors and hand digging tools may be used. For payload particles or other debris that may have entered the shallow lagoon or ocean waters, divers from the range would conduct underwater surveys to recover visible debris, again using only hand tools. Should any debris impact in areas of sensitive biological resources, then USFWS and NMFS biologists would provide guidance and/or assistance in recovery operations to minimize impacts on such resources.

Although unlikely, USAKA/RTS personnel would conduct a helicopter or fixed-wing aircraft overflight of the islet vicinity within several hours after the test to survey for any dead or injured marine mammals and sea turtles. Additionally, within approximately 1 day after the test, USAKA/RTS, USFWS, and/or NMFS biologists would conduct surveys on Illeginni Islet and in the near-shore waters for any injured wildlife or damage to sensitive habitats. As part of this effort, USFWS and NMFS biologists would assist USAKA/RTS in the recovery and rehabilitation of any injured migratory birds or sea turtles found at Illeginni.

Range equipment similar to that used during pre-test preparations would be transported to Illeginni Islet on a barge and/or LCU as part of operations to remove PDV debris and temporary support equipment and materials, and to assist with cleanup and repair activities. Any craters would be filled in and repairs made to surrounding structures, as necessary. All equipment, test materials, and related debris would be

transported back to Kwajalein Islet. In preparation for the CSM Demonstration test, the USAF would prepare a post-test recovery/cleanup plan detailing these actions. To minimize potential impacts on biological resources at Illeginni, the USAF would consult with the Pacific Island Regional Offices of the USFWS and NMFS during plan development.

Prior to returning the test support equipment and materials to the US, the equipment and materials would be washed and a certified Pest Control Technician would inspect them again to ensure that no insects, animals, plants, or seeds were picked up during fielding activities.

### **BOA Alternative**

Immediately following the flight test, the LCUs, ocean tug, and/or other support vessels would return to the barges. Following an inspection by UXO personnel, test support personnel would wet or wash down the barge decks to stabilize fugitive dust, conduct an impact assessment of the barges and the test support equipment and materials on the decks, and recover visible PDV debris. Personnel working on the barges would wear proper PPE, as necessary. The ocean tug would then tow the barges back to USAKA/RTS to remove the equipment and materials from the decks and make repairs.

If damage to any one of the barge hulls is too extensive, such that towing it back to USAKA/RTS would present a hazard to navigational safety for the tug or other vessels, then test support personnel would consider sinking the damaged barge in place. Prior to scuttling the barge, USAKA/RTS would alert the RMI Government on the circumstances for the action. Personnel at the barge location would attempt to remove remaining fluids (i.e., diesel fuel, engine coolant, oil, and hydraulic fluid) and batteries from any onboard hydraulic power units, and test support equipment from the deck, and load them onto the other barges or support vessels. Equipment and materials would be removed from the damaged barge only if it is feasible and can be conducted safely. A small explosive charge would be used to sink the damaged barge; however, the barge would only be scuttled after the area is determined to be clear of marine mammals and sea turtles out to a safe distance that is based on the intended explosives. The damaged barge and test debris would sink thousands of feet to the ocean floor. Because the barge, test equipment and materials, and PDV components are primarily metal, little or no floating debris is expected. Any floating debris would be collected for proper disposal in accordance with USAKA/RTS policies and procedures.

Post-test operations would also include the recovery of all free-floating sensor rafts using the LCUs or other vessels. Following all recovery operations, the Army vessels, including the USAV Worthy, would return to their homeport at USAKA/RTS. The test support equipment and materials, and related debris, would be shipped back to the US. Prior to CSM Demonstration implementation in the BOA, the USAF would prepare a post-test recovery/cleanup plan detailing these actions.

If during recovery operations, ship personnel were to identify any injured or dead marine mammals or sea turtles, then the personnel would report the information to the USAKA Environmental Management Office, which would then inform the NMFS in Honolulu. USAKA/RTS aircraft pilots operating in the vicinity of the impact and test support area would also report any opportunistic sightings of dead or injured animals.

## **2.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, the CSM Demonstration flight test proposed to occur at Vandenberg AFB and at USAKA/RTS would not be conducted. By not implementing the Proposed Action, the USAF would not be able to achieve the goal of demonstrating CPGS technologies for future capabilities in

support of our nation's defense. Laboratory testing of subsystems and hardware may continue; however, USAF CSM system development would be slowed or postponed.

## 2.3 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Although computer simulations, modeling, and other laboratory tests are typically used during the design and early evaluation of new aerospace systems, such methods cannot provide all of the information needed to satisfy mission requirements (e.g., verify system operation and performance). Alternatives that relied solely on such methods would not satisfy the purpose and need and thus were eliminated from further consideration.

The Peacekeeper Stage-1 rocket motor (the same Stage 1 used on the Minotaur IV Lite) is a START Treaty compliant motor; thus, it is subject to START and other arms control-treaty limitations. Provisions of the START Treaty require that the launch site be START inspectable. Because Vandenberg AFB offers several START-inspectable launch sites and conducts three to four long-range missile tests to USAKA/RTS every year, the base was identified as the only reasonable launch site for conducting the CSM Demonstration. Other possible launch sites (i.e., Kodiak Launch Complex, Alaska, and the Pacific Missile Range Facility, Hawaii) are not START compliant at this time, and/or they do not provide a long enough flight distance to USAKA/RTS to fully meet CSM Demonstration objectives.

At Vandenberg AFB, the USAF considered other alternative launch pads in addition to TP-01. Like TP-01, both Launch Facility (LF) 05 and LF-06, located near the north end of Vandenberg AFB, are START inspectable. LF-06, however, is not approved for Peacekeeper-derived launches under START; thus, the site cannot be used for Minotaur IV Lite launches without undertaking substantial coordination and approvals through DoD's Treaty Compliance Review Group. LF-05 is a prior Peacekeeper silo test launch facility; however, explosive safety restrictions during proposed CSM Demonstration activities could conflict with other missions by restricting road access to launch sites located further north. Because of these conflicts and other possible flight safety concerns for privately-owned property off range, both LF-05 and LF-06 were deemed unreasonable for the CSM Demonstration mission.

For payload processing at Vandenberg AFB, other alternative facilities considered were: (1) Astrotech Payload Processing facility (Building 1032); (2) Spaceport Systems International Integration Processing Facility (Building 375); (3) Hazardous PPF (Building 1610); and (4) Payload Fairing Processing Facility (Building 8337). All of these facilities were deemed unreasonable because of either excess operational costs, being located too far from the TP-01 launch pad, or that the facilities are commercially operated.

Provisions of the START Treaty also require that certain telemetry flight data collected during Peacekeeper-derived missions, including the CSM Demonstration, must be unencrypted and provided to the DoD for dissemination to the signatories of the treaty. For the collection of telemetry and other electro-optical data, the USAKA/RTS offers extensive instrumentation and infrastructure in a terminal range impact area. No other US range offers such capabilities and a land impact area for long-range missile tests.

At USAKA/RTS, use of Illeginni Islet for a land impact would best demonstrate and record the operational effectiveness of the CSM Demonstration. The USAF considered other land impact sites (e.g., Wake Atoll located approximately 590 nmi [1,090 km] north of USAKA/RTS and Bigen Islet located at Aur Atoll about 190 nmi [350 km] east-southeast of USAKA/RTS). These locations, however, do not have the necessary instrumentation in place and they present significant safety and environmental impact concerns because of islet populations, fuel storage facilities, and/or sensitive resources.

## **2.4 COMPARISON OF ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES**

Table 2-3 presents a comparison of the potential environmental consequences of the Proposed Action and the No Action Alternative for those locations and resources affected. Only those resource areas potentially affected are addressed (see Chapter 3.0 for a rationale of resources analyzed). A detailed discussion of the potential effects is presented in Chapter 4.0 of this EA.

## **2.5 IDENTIFICATION OF THE PREFERRED ACTION**

The USAF Preferred Action is to implement the Proposed Action at Vandenberg AFB and at USAKA/RTS using the Preferred Alternative (Illeginni Islet) land impact site, as described in Section 2.1 of this EA.

**Table 2-3. Comparison of Potential Environmental Consequences**

Locations and Resources Affected	Proposed Action	No Action Alternative
<b>Vandenberg Air Force Base, CA</b>		
Air Quality	The proposed facility modifications and construction are not expected to have an adverse effect on local or regional air quality. The CSM Demonstration launch represents a short-term, discrete event. In boost flight, the rocket emissions from each stage would be rapidly dispersed over a large geographic area and by prevailing winds. The total direct and indirect emissions associated with the Proposed Action at Vandenberg AFB were estimated to include release of 0.22 tons (0.20 metric tons) of volatile organic compounds (VOC) and 5.35 tons (4.85 metric tons) of total particulate matter. Emission levels would not exceed <i>de minimis</i> (minimal importance) thresholds, be regionally significant, or contribute to a violation of Vandenberg AFB's air operating permits. No exceedance of air quality standards or health-based standards for non-criteria pollutants would be anticipated.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to air quality would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.1 of the EA.
Noise	Because most CSM Demonstration activities would take place on base, the public in the surrounding communities would not detect an increase in noise levels except during the launch. Launch noise levels near TP-01 would exceed 130 decibels (dB) A-weighted Sound Exposure Level (ASEL). The small community of Casmalia would be exposed to launch noise levels up to approximately 95 dB ASEL, while the Cities of Santa Maria and Lompoc would be well outside the 85-dB noise contour. Launch noise would occur only once, be very short in duration (about 20 seconds of intense sound), and have little effect on the Community Noise Equivalent Level (CNEL) for these areas. Because the flight trajectory would be in a westerly direction, sonic booms would not be audible on any coastal areas, including the northern Channel Islands.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to the noise environment would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.2 of the EA.
Biological Resources	The disturbance and removal of vegetation during reestablishment of firebreaks and trenching activities is likely to "adversely affect" the Federally endangered ESBB and the Federally threatened California red-legged frog. Rocket launch emissions and ground-level heat from the rocket plume are expected to have minimal effects on nearby vegetation, wildlife, and surface water habitats. Exposure to short-term noise from launches and helicopter overflights (if conducted) could cause startle effects in protected bird species, pinnipeds, and other wildlife. However, on the basis of prior monitoring studies conducted on base, biologists determined that rocket launch activities have negligible, short-term impact on marine mammals, sea and shore birds, and other protected species. Because of the potential for adverse affects on the ESBB and the California red-legged frog, the USAF entered into formal consultation with the USFWS. By implementing measures identified in the USFWS BO, the USFWS concluded that the proposed activities would not jeopardize the continued existence of the two species.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to biological resources would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.3 of the EA.
Cultural Resources	Excavation work would be conducted in pre-disturbed areas and thus the activities are not expected to disturb known archaeological sites. Vegetation removal and maintenance at TP-01 would use methods that minimize soil disturbance in the vicinity of known archaeological sites. In addition, use of historic facilities would be minimal and short term. Thus, no significant impacts to cultural resources are expected. Because of prior consultations completed for MDA's KEI program, the base Cultural Resources Office does not anticipate the need to re-engage in consultations with the SHPO for the CSM Demonstration. Additionally, the Elders Council for the Santa Ynez Band of Chumash Indians	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to cultural resources would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.4 of the EA.



**Table 2-3. Comparison of Potential Environmental Consequences**

<b>Locations and Resources Affected</b>	<b>Proposed Action</b>	<b>No Action Alternative</b>
	concluded that the proposed activities would not affect cultural resources on base.	
Coastal Zone Management	By conducting only one launch, the increase in beach closures would be minimal and not have a major effect on local recreation. In addition, the proposed CSM Demonstration activities would not have a significant impact on physical and natural resources or adversely affect the visual qualities of the coastline. Under the Proposed Action, the USAF would comply with Federal Coastal Zone Consistency regulations and the California Coastal Zone Management Program. Through consultations, the CCC agreed that the Proposed Action would not adversely affect coastal resources.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to coastal zone management would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.5 of the EA.
Water Resources	Through application of state-approved best management practices (BMPs), no impacts to water resources are expected during construction activities. In the event that a release of hazardous material or waste would occur, affected areas would be treated in accordance with applicable Federal, state, and local regulations. Although a nominal launch could result in a short-term, minor decrease in pH in surface waters, no long-term adverse effects to surface waters or groundwater would occur. Therefore, no significant impacts to water resources are expected to occur.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to water resources would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.6 of the EA.
Health and Safety	For the proposed facility modifications and construction activities at Vandenberg AFB, all program personnel would be required to comply with applicable AFOSH and OSHA regulations and standards. The launch vehicle integration and flight test represent routine types of activities at Vandenberg AFB. Allowable public risk limits for launch-related debris would be extremely low; individuals within the general public would not be exposed to a probability of casualty greater than 1 in 1,000,000 for a single mission. By adhering to established and proven safety standards and procedures, the level of risk to all personnel would be minimal.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to health and safety would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.7 of the EA.
Hazardous Materials and Waste Management	Minimal quantities of hazardous materials would be used during launch vehicle integration (less than 10 lb [4.5 kg]). Mission support personnel would manage all hazardous materials in accordance with well-established policies and procedures. Hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable Federal, state, local, DoD, and USAF regulations. Hazardous material and waste-handling requirements would not exceed current capacities and management programs would not have to change.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts on hazardous materials and waste management would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.1.8 of the EA.
<b>Over-Ocean Flight Corridor and the Global Environment</b>		
Global Atmosphere	The CSM Demonstration flight test would release approximately 16 tons (14.5 metric tons) of hydrogen chloride (HCl) and 0.14 tons (0.13 metric tons) of free chlorine (Cl) into the atmosphere. However, solid rocket motors make a relatively small contribution to global ozone losses compared to other sources. It is estimated that the emission loads of chlorine (as HCl and Cl) from rocket launches worldwide, as projected from 2004 to 2014, would account for only 0.5 percent of the industrial Cl load	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts on the stratospheric ozone layer and on global warming would not occur. Conditions

**Table 2-3. Comparison of Potential Environmental Consequences**

Locations and Resources Affected	Proposed Action	No Action Alternative
	from the US over the 10-year period. The greenhouse gas (GHG) emissions from all combined CSM Demonstration activities at Vandenberg AFB and from the launch would release approximately 230 tons (209 metric tons) of carbon dioxide (CO <sub>2</sub> ). This amount of CO <sub>2</sub> represents less than 0.0001 percent of the anthropogenic emissions for this gas released on a global scale annually. As a result, the flight test would not contribute significantly to ozone layer depletion or to global warming.	are not expected to change from that described for the Affected Environment in Section 3.2.1 of the EA.
Biological Resources	The underwater propagation of sonic booms produced by the Minotaur IV Lite booster during launch is not expected to exceed 7.2 pounds per square foot (psf) (a conservative estimate based on the Atlas V booster), which is equivalent to 171 dB (referenced to 1 microPascal [re 1 $\mu$ Pa]) in water. Following PDV separation from the booster, as the test vehicle begins to hypersonic glide towards USAKA/RTS, it also would generate a moving sonic boom or carpet boom with a maximum peak overpressure of 0.21 psf (equivalent to 140 dB [re 1 $\mu$ Pa] in water). The PDV carpet booms over the NWHI would be minimal in strength (about 111 dB [re 20 $\mu$ Pa] in air and 137 dB [ref to 1 $\mu$ Pa] underwater), resulting in minimal impacts to migratory birds, seals, and other species at these islands. Following launch of the Minotaur IV Lite booster, spent rocket motors could strike marine life in the open ocean, and the resulting underwater shock/sound wave could cause auditory effects, other injuries, or death to protected marine mammals and sea turtles. Because of the limited ocean areas affected and the low density of protected species, the potential risk to animals is negligible. Seawater would rapidly dilute hazardous materials released from the spent motors, and components would immediately sink to the ocean bottom, out of reach of marine mammals, sea turtles, and most other marine life. In response to consultations, the NMFS concurred with the USAF's determination that conducting a single flight test from Vandenberg AFB to USAKA/RTS is not likely to adversely affect marine species or critical habitats protected under the ESA and RMI statutes.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts on biological resources would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.2.2 of the EA.
<b>US Army Kwajalein Atoll/Reagan Test Site and the Marshall Islands</b>		
Air Quality	For both the Preferred Alternative and the BOA Alternative, there would be no exceedance of UES air quality standards, no new permanent stationary sources of emissions, and no changes to air emission permits. Previous air and soil sampling at Illeginni Islet have not shown elevated levels of Be or depleted uranium (DU) as a result of prior ICBM reentry vehicle flight tests at the same location. Thus, any test-related disturbance of the soil within the impact area would not generate additional hazardous air pollutants (HAPs). Because of trade winds, evacuation procedures, and the lack of populated areas within miles of the alternative impact sites, there would be no inhalation risks to personnel or residents.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts to air quality would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.3.1 of the EA.
Noise	For both alternatives, RMI communities in the region would be exposed to PDV sonic booms, but only once within each community and at sound levels well within UES policies and US Army standards for impulse noise. Detonation of the integrated payload just prior to PDV impact would generate very loud noise levels—a peak sound pressure level of 180 dB just below the impact site. Because of evacuation procedures and the remoteness of the alternative impact sites, no residents or test support personnel would be affected.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts on noise would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.3.2 of the EA.

**Table 2-3. Comparison of Potential Environmental Consequences**

<b>Locations and Resources Affected</b>	<b>Proposed Action</b>	<b>No Action Alternative</b>
Biological Resources	<p>Pre-test preparations for both alternatives would have minimal effects on migratory birds, marine mammals, sea turtles, and other species. The sonic boom generated by the PDV would not exceed threshold levels for the onset of temporary threshold shift (TTS). Noise from the integrated payload detonation would only exceed TTS levels for the BOA Alternative. The resulting shockwave in the form of airborne vibrations could potentially cause brief rattling and minor cracking in adjacent reef areas at Illeginni Islet; however, such effects would be minimal.</p> <p>For the Preferred Alternative at Illeginni Islet, particle impacts “may affect” protected sea turtles, sea turtle nesting habitat, and mollusks; however, the risks for adverse effects are low. There is also low risk for payload particles to pierce or bury into the coral reef. To minimize long-term risks to migratory birds and marine life, all visible test debris would be recovered and removed from the islet and shallow waters. In all cases, post-test recovery and cleanup operations would be conducted in a manner to minimize further impacts on biological resources. By implementing measures identified in the USFWS BO, the USFWS concluded that the proposed activities would not jeopardize the continued existence of the green and hawksbill sea turtles.</p> <p>For the BOA Alternative, PDV and payload particle impacts in the ocean would not have a significant impact on marine mammals or sea turtles because the impact footprint is small and listed species are believed to have low and patchy densities within the BOA. In response to consultations, the NMFS concurred with the USAF’s determination that conducting a single CSM Demonstration flight test is not likely to adversely affect marine species or critical habitats protected under the ESA and RMI statutes.</p>	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts on biological resources would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.3.3 of the EA.
Health and Safety	CSM Demonstration preparations at USAKA/RTS would not introduce new types of activities or increase levels of risk to support personnel. The proposed flight test and impacts in the Marshall Islands would be conducted using the same USAKA/RTS range safety standards as those applied to ongoing ICBM hypersonic vehicle tests and other flight-test programs. Allowable risk limits for the general public would not exceed 1 in 1,000,000 for casualty to an individual from a single mission.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts on health and safety would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.3.4 of the EA.
Hazardous Materials and Waste Management	Pre-test preparations would require use of fuels and lubricants for range equipment operations. Impact of the PDV would introduce small quantities of toxic metals, batteries, and explosive devices into the environment; however, post test operations would include the recovery of all visible test debris from the Illeginni Islet impact site or from the barges in the BOA. All hazardous and non-hazardous wastes would be properly disposed of in accordance with the UES. Hazardous material and waste-handling capacities would not be exceeded, and management programs would not have to change.	The proposed CSM Demonstration activities would not be implemented; therefore, project related impacts on hazardous materials and waste management would not occur. Conditions are not expected to change from that described for the Affected Environment in Section 3.3.5 of the EA.

## 3.0 AFFECTED ENVIRONMENT

This chapter describes the environmental resources at the installations and other locations identified in the Proposed Action—Vandenberg AFB, the over-ocean flight corridor, and USAKA/RTS and the Marshall Islands. The chapter is organized by installation/location, describing each environmental resource or topical area that could be affected at that site by implementing the Proposed Action. The information and data presented are commensurate with the importance of the potential impacts in order to provide the proper context for evaluating impacts. Sources of data used and cited in the preparation of this chapter include available literature (such as EAs, EISs, and other environmental studies), installation and facility personnel, and regulatory agencies. The rationale for excluding certain environmental resources from further study is described in the introductory section for each installation/location.

The information contained in this Chapter serves as the baseline against which the predicted effects of the Proposed Action can be compared. The potential environmental effects of the Proposed Action and No Action Alternative are discussed in Chapter 4.0.

### 3.1 VANDENBERG AIR FORCE BASE

Vandenberg AFB is located in Santa Barbara County on the central coast of CA, about 50 mi (240 km) northwest of the City of Santa Barbara (Figure 3-1). Covering more than 98,000 acres (39,660 hectares), it is the third largest USAF installation. A primary mission for the base is to conduct and support space and missile launches. Located along the Pacific coast, Vandenberg AFB is the only facility in the US from which unmanned Government and commercial satellites can be launched into polar orbit, and where land-based ICBMs can be launched to verify weapon system performance.



Figure 3-1. Location of Vandenberg AFB, CA

## Rationale for Environmental Resources Analyzed

The proposed CSM Demonstration activities at Vandenberg AFB could impact air quality, noise, biological resources, cultural resources, coastal zone management, water resources, health and safety, and hazardous materials and waste management (including pollution prevention), and as such, only these environmental resource topics are discussed. Much of the information presented in this section was drawn from the Affected Environment chapter of the OSP EA (USAF, 2006). Pertinent new information was included where applicable to account for changes in the affected environment or the availability of updated data.

Some resource topics were not analyzed further at Vandenberg AFB because: (1) the Proposed Action requires limited ground-disturbing activities, thus no impacts to soils would be expected; (2) there would be little increase in personnel on base, thus no socioeconomic concerns are anticipated; (3) given the launch trajectory of the proposed CSM Demonstration flight test, the protection provided by range safety regulations and procedures, and the occurrence of launch noise over a wide area, there would be no disproportionate impacts to minority populations and low-income populations under Executive Order 12898 (*Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*); (4) launch operations would be conducted in accordance with Western Range operating procedures and would not expand or alter currently controlled airspace; and (5) the proposed launches represent activities that are consistent with the *Vandenberg Air Force Base General Plan* (VAFB, 2007d) and well within the limits of current base operations. As a result, there would be no adverse effects on land use, utilities, or transportation.

### 3.1.1 AIR QUALITY

The US Environmental Protection Agency (USEPA), the California Air Resources Board (CARB), and the Santa Barbara County Air Pollution Control District (SBCAPCD), regulate air quality in Santa Barbara County and at Vandenberg AFB. The Clean Air Act (42 USC 7401-7671), as amended, gives USEPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) that set acceptable concentration levels for seven criteria pollutants: particulate matter less than 10 microns in diameter ( $PM_{10}$ ), particulate matter less than 2.5 microns in diameter ( $PM_{2.5}$ ), sulfur dioxide ( $SO_2$ ), carbon monoxide (CO), nitrogen oxides ( $NO_x$ ), ozone ( $O_3$ ), and lead (Pb). In addition, the State of California instituted the California Ambient Air Quality Standards (CAAQS), which includes additional standards for the Federally identified criteria pollutants, as well as sulfates, hydrogen sulfide, vinyl chloride (chloroethene), and visibility reducing particles. Short-term standards (1-, 8-, and 24-hour periods) were established for pollutants that contribute to acute health effects, while long-term standards were established for pollutants that contribute to chronic health effects.

Air-Quality Control Regions (AQCRs) that exceed the NAAQS and CAAQS are designated nonattainment areas and those in accordance with the standards are attainment areas. Vandenberg AFB is in the South Central Coast Intrastate AQCR (AQCR 032) (40 CFR 81.166). Both the USEPA and CARB designated Santa Barbara County as being in attainment of all Federal and state standards except for the 8-hour  $O_3$  CAAQS and the  $PM_{10}$  CAAQS (40 CFR 81.305; SBCAPCD, 2009a).

The CARB monitors levels of criteria pollutants at representative sites throughout CA. Table 3-1 outlines the NAAQS, CAAQS, and ambient concentrations of the criteria pollutants as measured by monitoring stations at Vandenberg AFB and in nearby Santa Maria. These concentrations are conservative estimates of the air-quality conditions at Vandenberg AFB. For both  $O_3$  and  $PM_{10}$ , the CAAQS nonattainment status is reflected in the locally recorded values shown in Table 3-1. Because air quality is measured and regulated on a regional level, and  $O_3$  forms in the atmosphere some distance from the location of the

Table 3-1. Air Quality Standards and Ambient Air Concentrations at or near Vandenberg AFB, CA

Pollutant	2006		2007		2008		California Standards <sup>1</sup>	Federal Standards <sup>2</sup>	
	South VAFB	Santa Maria	South VAFB	Santa Maria	South VAFB	Santa Maria		Primary <sup>3</sup>	Secondary <sup>4</sup>
<b>Ozone (parts per million [ppm])</b>									
1-hour highest <sup>5</sup>	0.070	0.064	0.082	0.065	0.083	0.072	0.09	-	-
1-hour 2 <sup>nd</sup> highest	0.063	0.063	0.076	0.059	0.076	0.070	-	-	-
8-hour highest <sup>6</sup>	0.063	0.062	0.074	0.054	0.080	0.064	0.070	0.075	Same as Primary Standard
8-hour 2 <sup>nd</sup> highest	0.060	0.058	0.071	0.051	0.072	0.056	-	-	-
<b>CO (ppm)</b>									
1-hour highest	0.3	1.5	1.2	1.6	1.6	1.6	20	35	-
1-hour 2 <sup>nd</sup> highest	0.3	1.5	1.2	1.4	1.3	1.3	-	-	-
8-hour highest	0.3	0.7	0.9	0.9	0.7	0.7	9	9	-
8-hour 2 <sup>nd</sup> highest	0.3	0.7	0.8	0.7	0.6	0.6	-	-	-
<b>NO<sub>2</sub> (ppm)</b>									
1-hour highest	0.016	0.037	0.014	0.048	0.014	0.043	0.18	-	-
1-hour 2 <sup>nd</sup> highest	0.016	0.035	0.012	0.048	0.011	0.041	-	-	-
Annual Arithmetic Mean	0.001	0.008	0.001	0.011	0.001	0.009	0.030	0.053	Same as Primary Standard
<b>SO<sub>2</sub> (ppm)</b>									
1-hour highest	0.007		0.006		0.004		0.25	-	-
1-hour 2 <sup>nd</sup> highest	0.005		0.005		0.003		-	-	-
3-hour highest	0.005	(no data)	0.003	(no data)	0.003	(no data)	-	-	0.50
3-hour 2 <sup>nd</sup> highest	0.003		0.001		0.002		-	-	-
24-hour highest	0.002		0.001		0.002		0.04	0.14	-
24-hour 2 <sup>nd</sup> highest	0.002		0.001		0.001		-	-	-
Annual Arithmetic Mean	0.001		0.001		0.001		-	0.03	-
<b>PM<sub>10</sub> (micrograms per cubic meter [µg/m<sup>3</sup>])</b>									
24-hour highest	55	54	68	58	44	61	50	150	Same as Primary Standard
24-hour 2 <sup>nd</sup> highest	43	49	39	53	43	57	-	-	-
Annual Arithmetic Mean	18	22	19	24	20	29	20	-	-

**Table 3-1. Air Quality Standards and Ambient Air Concentrations at or near Vandenberg AFB, CA**

Pollutant	2006		2007		2008		California Standards <sup>1</sup>	Federal Standards <sup>2</sup>	
	South VAFB	Santa Maria	South VAFB	Santa Maria	South VAFB	Santa Maria		Primary <sup>3</sup>	Secondary <sup>4</sup>
<b>PM<sub>2.5</sub> (µg/m<sup>3</sup>)</b>									
24-hour highest		17.0		18.7		15.3	-	35	Same as Primary Standard
24-hour 2 <sup>nd</sup> highest	(no data)	13.0	(no data)	16.0	(no data)	15.1	-	-	-
Annual Arithmetic Mean		7.6		7.9		8.0	12	15	Same as Primary Standard

Notes:

<sup>1</sup> California standards for ozone, carbon monoxide, sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, and particulate matter are not to be exceeded values.

<sup>2</sup> National averages (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year, with a maximum hourly average concentration above the standard, is equal to or less than one.

<sup>3</sup> National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

<sup>4</sup> National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects from a pollutant.

<sup>5</sup> Not to be exceeded on more than an average of 1 day per year over a 3-year period.

<sup>6</sup> Not to be exceeded by the 3-year average of the annual 4th highest daily maximum 8-hour average.

Sources: 17 California Code of Regulations (CCR) 70200; 40 CFR Part 50; 73 FR 16436-16514; USEPA, 2008.

precursors' emissions, the region of influence (ROI) for the air quality analysis is AQCR 032, Santa Barbara County, and the immediate offshore area.

SBCAPCD maintains a comprehensive inventory of air pollutants released within the county. This inventory accounts for types and amounts of pollutants emitted from a wide variety of sources, including on-road motor vehicles, fuel combustion at industrial facilities, solvent and surface coating usage, consumer product usage, and emissions from natural sources. The emission inventory is used to describe and compare contributions from air pollution sources, evaluate control measures, schedule rule adoptions, forecast future pollution, and prepare clean air plans. Tables 3-2 and 3-3 provide the latest available information on the overall emissions for Santa Barbara County. Emission levels of NO<sub>x</sub> and Volatile Organic Compounds (VOC) are of particular importance because of their contribution to ground level ozone and smog.

Table 3-2. 2002 Area and Point Source Emissions for Santa Barbara County, CA (Tons per Year)						
Source	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
Area Sources	88,345	50,301	10,541	5,631	22,469	20,741
Point Sources	1,627	1,692	251	122	1,271	1,450
<b>Total</b>	<b>89,972</b>	<b>51,993</b>	<b>10,792</b>	<b>5,753</b>	<b>23,740</b>	<b>22,191</b>

Source: USEPA, 2008.

Table 3-3. 2002 Ozone Precursor Emissions for Santa Barbara County, CA (Tons per Year)	
NO <sub>x</sub>	VOC
16,111	43,140

Source: SBCAPCD, 2009a.

Stationary sources of air emissions on Vandenberg AFB (including both point and area sources) include abrasive blasting operations, boilers, generators, surface coating operations, turbine engines, wastewater treatment plants, storage tanks, aircraft operations, soil remediation, launch vehicle fueling operations, large aircraft starting systems, and solvent usage. On-base mobile sources of air emissions include various aircraft, missile and spacecraft launches, and numerous Government and personal motor vehicles (VAFB, 2005a). Table 3-4 provides information on the overall emissions for Vandenberg AFB in 2006. Notably, the base's emissions constitute less than 0.5 percent of the total countywide emissions of all criteria pollutants.

Table 3-4. 2006 Criteria Air Pollutant Emissions for Vandenberg AFB, CA (Tons per Year)					
CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
1,076.0	216.4	11.8	4.1	2.93	140.1

Source: CARB, 2009a; VAFB, 2007c.



At Vandenberg AFB, wind and other meteorological conditions are critical for the dispersion of emissions. The mean annual wind speed in the area is 7 miles per hour (mph) (11.3 kilometers per hour [kph]) out of the northwest. The strongest winds occur during the winter and midday, and at ridgelines. Over half of the time, the wind blows at speeds greater than 7 mph (11.3 kph). The entire south-central coastal region experiences a persistent subsidence inversion resulting from a Pacific high-pressure region. The average maximum daily inversion height ranges from 1,600 ft (488 m) during the summer to 2,800 ft (853 m) during the winter (USAF, 1998).

### 3.1.2 NOISE

Noise is most often defined as unwanted sound that is heard by people or wildlife and that interferes with normal activities or otherwise diminishes the quality of the environment. Sources of noise may be transient (e.g., a passing train or aircraft), continuous (e.g., heavy traffic or air conditioning equipment), or impulsive (e.g., a sonic boom or a pile driver). Sound waves traveling outward from a source exert a sound pressure measured in dB.

The human ear is not equally sensitive to all sound wave frequencies. Sound levels adjusted for frequency-dependent amplitude are called “weighted” sound levels. Weighted measurements emphasizing frequencies within human sensitivity are called A-weighted decibels (dBA). Established by the American National Standards Institute, A-weighting significantly reduces the measured pressure level for low-frequency sounds, while slightly increasing the measured pressure level for some high-frequency sounds. In summary, A-weighting is a filter used to relate sound frequencies to human-hearing thresholds. Typical A-weighted sound levels measured for various sources are provided in Figure 3-2.

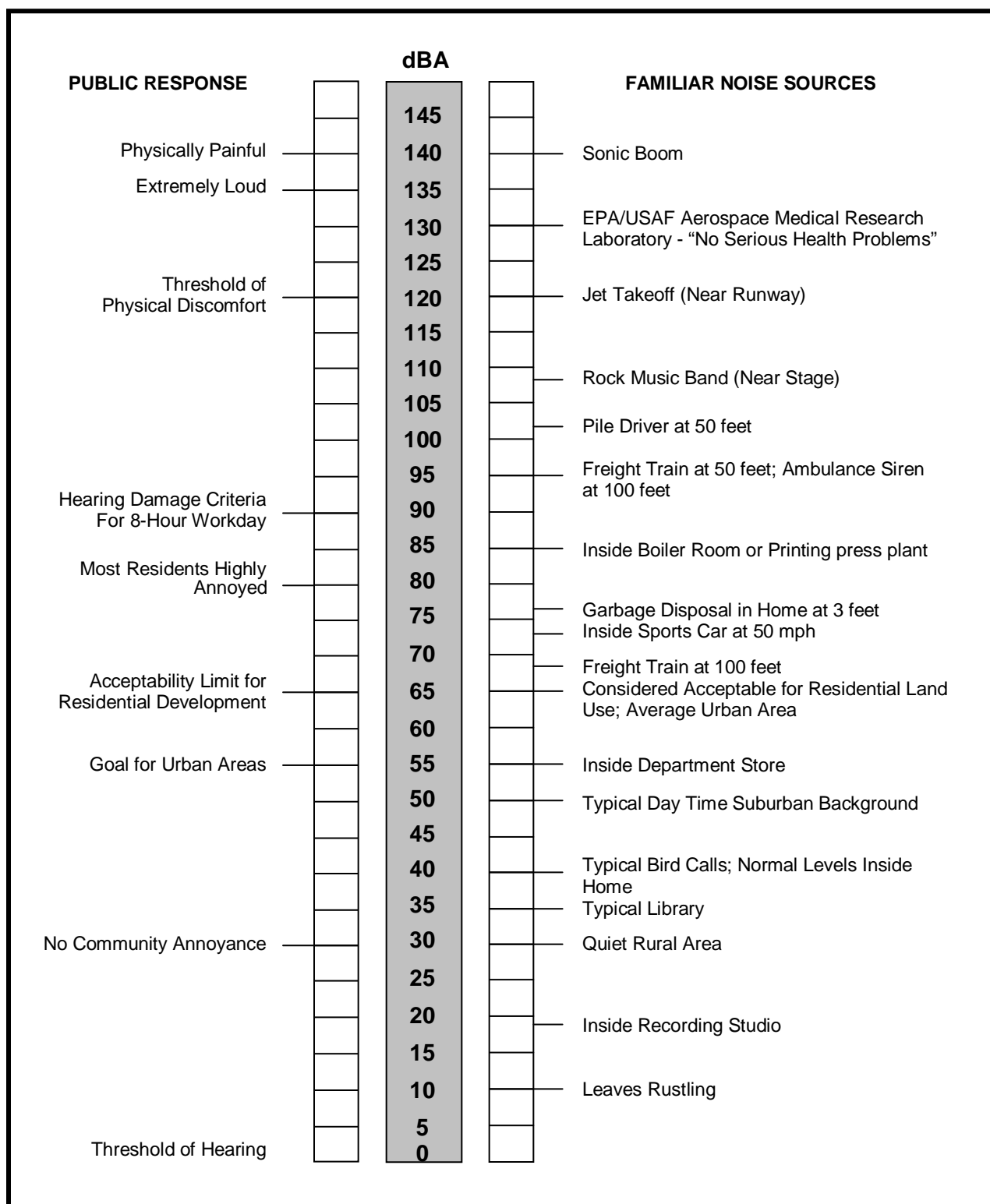
The greatest sound pressure level recorded during a specific period of time is termed the peak sound pressure level, further qualified as weighted or unweighted (i.e., unfiltered). Peak sound values can be too short and at a frequency missed by the human ear. Sound Exposure Level (SEL), however, is a composite cumulative energy metric of a sound’s amplitude and duration, and is qualified as weighted or unweighted. If the SEL is A-weighted, then it is referred to as ASEL, which is one of the most common metrics used for determining noise exposure effects on humans.

USAF standards require hearing protection whenever a person is exposed to steady-state noise of 85 dBA or more, or impulse noise of 140 dB sound pressure level or more, regardless of duration. Personal noise protection is required when using noise-hazardous machinery or entering hazardous noise areas.

Air Force Occupational Safety and Health (AFOSH) Standard 48-20 (*Occupational Noise and Hearing Conservation Program*) describes the USAF Hearing Conservation Program procedures used at Vandenberg AFB. Similarly, under 29 CFR 1910.95, employers are required to monitor employees whose exposure to noise could equal or exceed an 8-hour time-weighted average of 85 dBA. For off-base areas, Vandenberg AFB follows state regulations concerning noise, and maintains a CNEL of 65 dBA or lower. CNELs represent day-night noise levels averaged over a 24-hour period, with “penalty” decibels added to quieter time periods (i.e., evening and nighttime). As a result, the CNEL is generally unaffected by the short and infrequent rocket launches occurring on base.

For noise analysis purposes in this EA, the ROI at Vandenberg AFB is defined as the area within the 85-dB ASEL contour generated by the proposed CSM Demonstration launch (see Figure 4-1). This ROI equates to an area within a few miles of the launch site.

Typical noise sources at Vandenberg AFB are automobile and truck traffic, aircraft operations (including landings, takeoffs, and training approaches and departures for both fixed-wing and rotary-wing aircraft),



Source: Modified from US Army Strategic Defense Command, 1991.

**Figure 3-2. Typical Noise Levels of Familiar Noise Sources and Public Responses**

and trains passing through the base (an average of 10 trains per day) (VAFB, 2005a). Existing noise levels on base are generally low, with higher levels occurring near industrial facilities and transportation routes.

The immediate area surrounding Vandenberg AFB is largely composed of undeveloped and rural land, with some unincorporated residential areas in the Lompoc and Santa Maria valleys, and Northern Santa Barbara County. A small number of industrial areas and small airports are located within the cities of Lompoc and Santa Maria (Figure 3-1), which are the two main urban areas in the region. Sound levels measured for these areas are typically low, but higher levels occur in the industrial areas and along transportation corridors. The rural areas of the Lompoc and Santa Maria valleys typically have low overall CNELs, normally about 40 to 45 dBA (USAF, 1998). Occasional aircraft flyovers can increase noise levels for a short period of time.

Other less frequent, but more intense, sources of noise in the region are from missile and space launches at Vandenberg AFB. These include Minotaur, Atlas V, and Delta IV launches from the South Base area, as well as Minuteman, Ground-based Midcourse Defense, Taurus, and Delta II launches from the North Base area. Depending on the launch vehicle and launch location on the base, resulting noise levels in Lompoc may reach an estimated maximum unweighted sound pressure level of 100 dB, and Santa Maria may reach 95 dB, each for an effective duration of about 20 seconds per launch. Equivalent A-weighted sound levels would be lower. Because launches from Vandenberg AFB occur infrequently, and the launch noise generated from each event is of very short duration, the average (CNEL) noise levels in the nearby areas are not affected (USAF, 1998, 2000, 2006).

Although rocket launches from Vandenberg AFB often produce sonic booms during the vehicle's ascent, the resulting overpressures are directed out over the ocean in the direction of the launch azimuth and generally do not affect the CA coastline. Depending on the launch azimuth, some launches from South Vandenberg can cause sonic booms to occur over portions of the northern Channel Islands (USAF, 1995, 1998, 2000).

### **3.1.3 BIOLOGICAL RESOURCES**

For purposes of analyzing biological resources at Vandenberg AFB, the ROI primarily consists of those land areas and near-shore waters within a few miles of the proposed launch site and associated launch azimuth (refer to Figure 2-3) that could be affected by facility modifications, pre-launch preparations, launch emissions, and launch and aircraft noise. Biological resources within deeper waters and the open ocean are described in Section 3.2.2.

#### **3.1.3.1 Vegetation**

Vandenberg AFB supports a wide variety of vegetation organized according to habitat types. These include Bishop pine forest, Tanbark oak forest, coastal live oak woodland, riparian woodland, chaparral, coastal sage scrub, purple sage scrub, coastal dune scrub, coastal bluff scrub, coastal strand, grasslands, coastal bluffs, and rocky headlands. Approximately 85 percent of Vandenberg AFB vegetation is natural, with the balance either invasive vegetation that has replaced natural flora (particularly non-native annual grasslands) or plants associated with developments (USAF, 2006; VAFB, 2005a).

As previously described in the OSP EA (USAF, 2006), there are several plants designated as Species of Concern (SOC)<sup>4</sup> (e.g., black flowered figwort, sand mesa manzanita, and Kellogg's horkelia) that may be

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<sup>4</sup> SOC is an informal term that applies to plants and animals not listed under the Federal ESA, but for which concerns for the future well-being of the taxon exist (USFWS, 2001).

found on North Vandenberg AFB, including the vicinity of TP-01. The area around TP-01 was originally disturbed and covered with imported fill during the pad's construction in 1982. Because the firebreak surrounding TP-01 has not been maintained for years, the vegetation surrounding the launch pad has overgrown and now consists of coastal dune scrub habitat that contains California sagebrush, goldenbush, lupine, coyote brush, seaciff buckwheat, and other species (Tetra Tech, 2007; VAFB, 2009b).

### 3.1.3.2 Wildlife

The various coastal environments and vegetation types found at Vandenberg AFB provide a wide range of habitats for many resident and migratory animals. While some species are associated with a specific habitat, others may be generalists, occupying multiple habitat communities. Such examples occurring near proposed CSM facilities may include the Western fence lizard, garter snake, brush rabbit, mule deer, California ground squirrel, and red-tailed hawk. As previously described in the OSP EA, several species found on North Vandenberg AFB are designated as SOC (e.g., western burrowing owl, marbled godwit, and Townsend's western big-eared bat) (USAF, 2006).

Surveys conducted on base have shown a large number of seabirds—including pigeon guillemots, pelagic cormorants, Brandt's cormorants, black oystercatchers, and western gulls—to occur along the coast, particularly around Point Sal, Purisima Point, and other points south. Recently removed from the Federal list of threatened and endangered wildlife due to recovery, the California brown pelican is also found along some of the rocky shores of Vandenberg AFB (74 FR 59443-59472). These and other bird species found on base are given additional protections under the Migratory Bird Treaty Act (Brown, et al., 2001; Robinette and Sydeman, 1999).

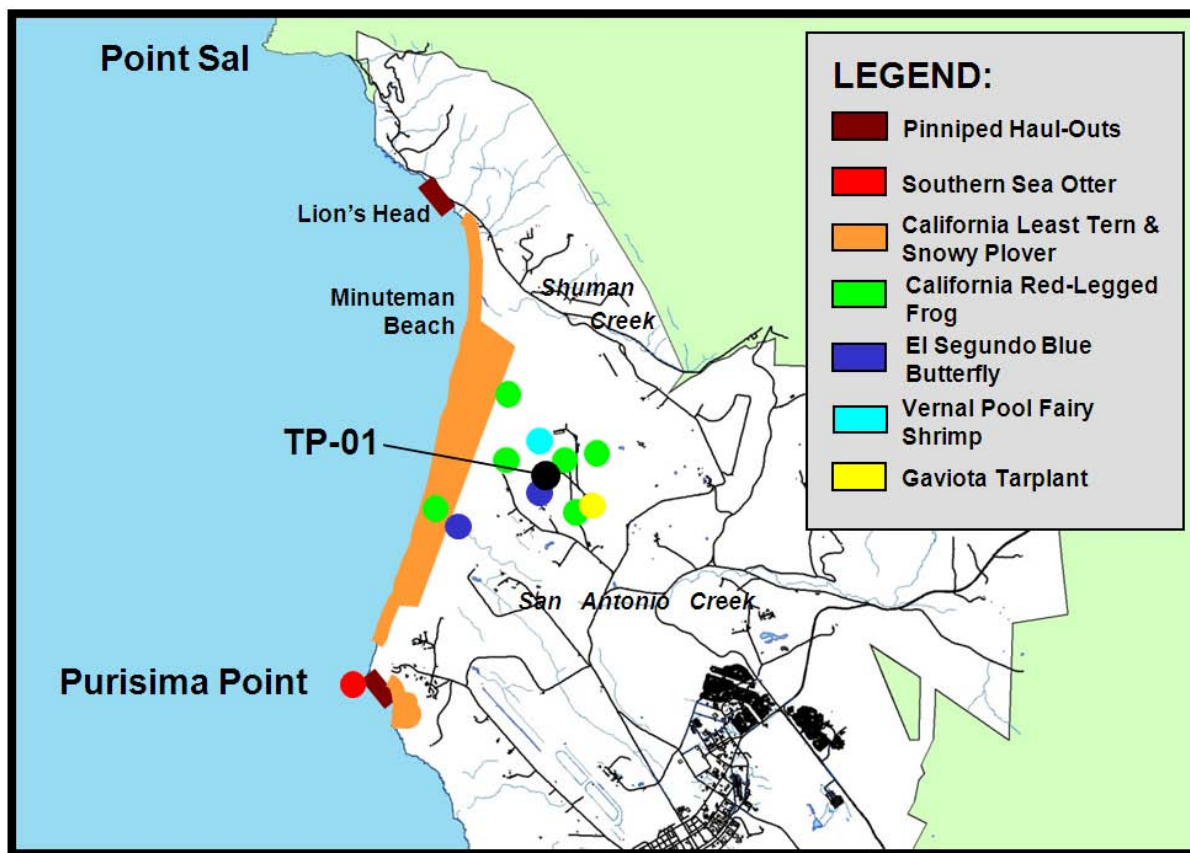
Regarding marine mammals, some species of seals and sea lions (pinnipeds) can be found within the ROI using beaches and rocky shores along Vandenberg AFB to rest, molt, and/or breed. Pinnipeds that may be found onshore ("hauled-out") within the ROI include the California sea lion (*Zalophus californianus*) and Pacific harbor seal (*Phoca vitulina richardsi*). None of these species are listed as endangered or threatened, but all receive Federal protection from harassment or injury under the Marine Mammal Protection Act (MMPA).

The Pacific harbor seal is the most common marine mammal inhabiting Vandenberg AFB, occurring year-round within the ROI at several haul-out sites along the base coastline. Purisima Point is a primary haul-out site (refer to Figure 3-3). Lion's Head has also been documented as a haul-out and pupping area for a small number of seals. The highest animal counts at Lion's Head, which average 20 seals, are made between September and January during the post-breeding period. Pupping occurs from March 1 through June 30. Harbor seals are considered particularly sensitive to disturbance during this period, when the risk of mother-offspring separation is greatest. To assess the potential long-term effects of launch noise on pinnipeds, Vandenberg AFB conducts biological monitoring for all launches during the harbor seal pupping season (March 1 to June 30) (74 FR 6236-6244; USAF, 2006).

Fewer than 200 California sea lions are found seasonally on Vandenberg AFB. Sea lions may sporadically haul-out to rest when in the North Vandenberg AFB area to forage or when transiting the area, but they are more likely to occur at coastal points further north and south of the ROI (69 FR 5720-5728; USAF, 2006).

### 3.1.3.3 Threatened and Endangered Species

Those threatened and endangered species found in proximity to the proposed CSM Demonstration launch site (TP-01) are listed in Table 3-5. Although not all inclusive, locations of these species are also shown in Figure 3-3.



Source: MDA, 2009; Tetra Tech, 2007; VAFB, 2007e, 2008b, 2009b.

**Figure 3-3. Protected Species and Sensitive Habitat near TP-01 at Vandenberg AFB, CA**

### 3.1.3.3.1 Listed Floral Species

Vandenberg AFB represents an important habitat for threatened and endangered plant species because human activities and invasive species are controlled on the base. The Federally endangered Gaviota tarplant is found at multiple locations on base. In 2006, the USAF observed over 285 acres (115 hectares) of occupied Gaviota tarplant habitat on base; however, no Gaviota tarplant was found during 2007 and 2009 biological surveys conducted around the TP-01 launch pad and along Rhea Road. The closest reported occurrence of Gaviota tarplant to TP-01 is 1.6 mi (2.6 km) away (Tetra Tech, 2007; USFWS, 2007).

### 3.1.3.3.2 Listed Faunal Species

As listed in Table 3-5 and shown in Figure 3-3, seven Federally listed wildlife species occur within the ROI at Vandenberg AFB. Discussions on each species are provided in the paragraphs that follow.

El Segundo blue butterflies (ESBB) were formerly thought to be restricted to Los Angeles County; however, invertebrate surveys conducted on Vandenberg AFB in 2004 and 2005 documented butterflies morphologically, temporally, and behaviorally consistent with ESBB. Based on these criteria, the USFWS considers the blue butterflies identified at Vandenberg AFB to be the ESBB until more definitive information becomes available (VAFB, 2009b). ESBBs depend solely on seaciff buckwheat (*Eriogonum*

**Table 3-5. Threatened and Endangered Species near TP-01 at Vandenberg AFB, CA<sup>1</sup>**

Common Name	Scientific Name	Federal Status	CA Status
<b>Plants</b>			
Gaviota tarplant	<i>Dienandra increscens ssp. villosa</i>	E	E
<b>Invertebrates</b>			
El Segundo blue butterfly	<i>Euphilotes battoides allyni</i>	E	-
Vernal pool fairy shrimp	<i>Branchinecta lynchi</i>	T	-
<b>Reptiles/Amphibians</b>			
California red-legged frog	<i>Rana aurora draytonii</i>	T	SOC
<b>Birds</b>			
California least tern	<i>Sterna antillarum browni</i>	E	E
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	T	SOC
<b>Mammals (includes nearshore waters)</b>			
Southern sea otter	<i>Enhydra lutris nereis</i>	T	CFP

**Notes:**

<sup>1</sup> The species listed are known to occur or are expected to occur year round or seasonally within the ROI.

E = Endangered                      CFP = California Fully Protected

T = Threatened                      SOC = Species of Concern

Source: MDA, 2009; Tetra Tech, 2007; VAFB, 2007e, 2008b, 2009b.

*parvifolium*) for much of their life cycle; thus, their occurrence is dependent upon the distribution of seacliff buckwheat, which is found at various locations on base. In 2007 and 2009, biological surveys conducted at TP-01 found a few hundred seacliff buckwheat plants scattered throughout the area bordering the launch pad and inside the original vegetation clear zone or firebreak (Tetra Tech, 2007; VAFB, 2009b). Numerous seacliff buckwheat plants were also found along Rhea Road from TP-01 to Building 1819, but the plants along the road have since been mowed. Four seacliff buckwheat plants were also found along the proposed firebreak at the end of the Rhea Road turn-around (VAFB, 2009b).

Vernal pool fairy shrimp live in ephemeral freshwater habitats, such as natural and man-made vernal pools and swales. The species prefers pools that are relatively short-lived—3 to 7 weeks, depending on the season. None are known to occur in running or marine waters, or in other permanent bodies of water. Fairy shrimp are expected to occur in some of the palustrine and ephemeral wetland areas near TP-01 (Tetra Tech, 2007; USAF, 2006; VAFB, 2008b).

The California red-legged frog prefers freshwater ponds and streams, usually with moderately deep pools, permanent water, and dense aquatic vegetation within and along water edges. Red-legged frogs are common on Vandenberg AFB and are found almost any place where suitable habitat exists. Within the ROI, most occurrences of the red-legged frog are along San Antonio Creek and within the scattered wetlands north and east of TP-01 (USAF, 2006; VAFB, 2008b, 2009b).

Two listed seabirds have been found within the ROI. California least terns have historically foraged and bred at several coastal locations from San Antonio Creek south, particularly at Purisima Point. Breeding colonies have varied from year to year in the number of nest attempts and, for some sites, are often not active at all. Least tern nesting generally occurs from April 15 through August 31. Vandenberg AFB also provides important nesting and wintering habitat for western snowy plovers. Plover nesting occurs on the

coastal dunes from the north end of Minuteman Beach to Purisima Point and areas further south. Nesting and chick rearing activity generally occurs between March 1 and September 30 (Robinette, et al., 2004; USAF, 2006; VAFB, 2008b).

The only listed marine mammal occurring at Vandenberg AFB is the Federally threatened southern sea otter, which can be observed year-round foraging and rafting within a few hundred yards of the shore anywhere kelp beds are present. Within the ROI, a resident breeding colony exists at Purisima Point. Semi-migratory individual otters also have been seen near Point Sal (USAF, 2006; VAFB, 2008b).

### 3.1.3.4 Environmentally Sensitive Habitats

Although several Federally listed species occur within the ROI, there are no USFWS-designated critical habitats located on the base property (VAFB, 2008b). Section 4(b)(2) of the ESA directs the Secretary of the Interior to not designate critical habitat on Vandenberg AFB or on other military installations as long as protective measures are included in the installation's Integrated Natural Resources Management Plan (INRMP).<sup>5</sup> In cooperation with the USFWS and the California Department of Fish and Game (CDFG), Vandenberg AFB identified habitats for special protection under its draft INRMP (VAFB, 2009a). In addition, the draft INRMP identifies protective measures for listed species, such as biological monitoring, surveying populations, and habitat restoration and enhancement.

For the western snowy plover nesting habitats along the beaches and coastal dunes of Vandenberg AFB (refer to Figure 3-3), the base has developed a management plan in cooperation with the USFWS for beach closures during the plover nesting season (March 1 through September 30). Also, to protect and promote the growth of the California least tern colony at Purisima Point, Vandenberg AFB has established a comprehensive management program that includes monitoring during the breeding season, predator management, and habitat enhancements (MDA, 2009; Robinette, et al., 2004; VAFB, 2008b).

Wetlands on Vandenberg AFB are ecologically important because they provide food, spawning areas, nursing grounds, and habitat for many species. Wetland types on the base include marine, estuarine, riverine, lacustrine, and palustrine, some of which are ephemeral. Major wetland areas on base can be found along San Antonio Creek. A number of small tidal wetlands occur along the Minuteman Beach shoreline. Numerous small non-tidal wetlands also exist along lesser stream drainages. Because of its location in the San Antonio Terrace, a peneplain of low relief, TP-01 is within 1,000 ft (305 m) of large wetland areas (USAF, 2006; VAFB, 2009b).

As amended and reauthorized in 2006, the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 104-297) requires regional Marine Fisheries Councils to manage fisheries to ensure stability of fish populations with support from the NMFS. Regional Marine Fisheries Councils prepare Fishery Management Plans that identify and protect the habitat essential to maintain healthy fish populations. Commercially important species are preferentially targeted. Threats to habitat from both fishery and non-fishery activities are identified, and actions needed to eliminate them are recommended. In CA, the Pacific Fishery Management Council (PFMC) is responsible for identifying essential fish habitat, which is generally defined as the waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (PFMC, 2009).

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<sup>5</sup> The Sikes Act (Conservation Programs on Military Installations) (16 USC 670) requires the DoD to prepare INRMPs for relevant installations in cooperation with the USFWS and the State fish and wildlife agencies. Revisions to the Act authorize the Secretary of the Interior to exclude DoD land from critical habitat designation where the Secretary finds that the INRMP provides a benefit to the species for which the critical habitat designation is proposed.

Fishes of commercial importance found just within and downrange from the ROI include coastal pelagic schooling squids and fishes (Pacific sardine, Pacific mackerel, and northern anchovy), groundfish (rockfish, flatfish, and Pacific whiting), and large, highly migratory pelagic fishes (tuna, swordfish, and sharks). Essential fish habitat identified by the PFMC for these species includes all marine and estuary waters from the coast of CA to the limits of the Exclusive Economic Zone, which extends 200 mi (322 km) seaward from the coast. Groundfish are species of commercial importance found within the shallow waters off Vandenberg AFB. More than 82 species of groundfish are identified in the Fishery Management Plan for this region (PFMC, 2009).

### **3.1.4 CULTURAL RESOURCES**

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. Cultural resources are limited, nonrenewable resources whose potential for scientific research (or value as a traditional resource) may be easily diminished by actions impacting their integrity.

Numerous laws and regulations require that possible effects to cultural resources be considered during the planning and execution of Federal undertakings. These laws and regulations stipulate a process of compliance and consultation, define the responsibilities of the Federal agency proposing the action, and prescribe the relationship among other involved agencies (e.g., SHPO and the Advisory Council on Historic Preservation). In addition to NEPA, the primary laws that pertain to the treatment of cultural resources during environmental analysis are the National Historic Preservation Act (especially Sections 106 and 110), the Archaeological Resources Protection Act, the Antiquities Act of 1906, the American Indian Religious Freedom Act, and the Native American Graves Protection and Repatriation Act. Depending on the integrity and historical significance of a site or property, it may be listed or eligible for listing on the National Register of Historic Places (NRHP).

The term ROI is synonymous with the “area of potential effect” as defined under cultural resources regulations, 36 CFR 800.16(d). In general, the ROI for cultural resources encompasses areas of planned ground disturbance (e.g., areas of new facility/utility construction) and all buildings or structures requiring modification, renovation, demolition, or abandonment. For the CSM Demonstration, minimal areas of soil disturbance are planned and facility modifications would be mostly temporary. Thus, the ROI for the Proposed Action consists of those buildings and facilities that are historic as well as adjacent areas where archaeological resources might occur. In cases of launch failures, the ROI would include areas of debris cleanup, firefighting, and other required post launch-anomaly activities.

#### **3.1.4.1 Archaeological Sites**

Numerous archaeological surveys at Vandenberg AFB have identified more than 2,200 prehistoric and historic cultural sites. Prehistoric sites have included dense shell middens (refuse heaps), stone tools, village sites, stone quarries, and temporary encampments (VAFB, 2005a). One of the facilities that would be used for activities under the Proposed Action (see Section 2.1.2.1) is located near a known archaeological site (Table 3-6).

#### **3.1.4.2 Historic Buildings and Structures**

As part of the World War II effort, the US Army acquired much of the current base area in 1941. The area, named Camp Cooke, served as a training area for armored and infantry units. In 1950, the base was re-activated in support of the Korean War. In 1957, the USAF took over the northern 65,000 acres of



**Table 3-6. Archaeological Sites in Relation to Proposed CSM Demo Support Facilities at Vandenberg AFB, CA**

Facility	Site Characteristics	NRHP Eligibility	Proximity to Facility
TP-01 (Facility 1840)	Prehistoric – Large “chipping station” flakes, tools, and cores	Not Determined	The west end of the TP-01 fenced area overlaps the site. Original construction of TP-01 placed several meters of imported fill over part of the site.

Source: MDA, 2009; USAF, 2006.

Camp Cooke and renamed it “Cooke AFB.” It was later renamed Vandenberg AFB in a ceremony held on October 4, 1958.

Since the late-1950s, the base has been used primarily to develop several types of intermediate and long-range ballistic missiles, and to launch both military and civilian payloads into space. A multi-year survey completed in 1996 identified more than 70 sites, complexes, and facilities that have been determined eligible for the NRHP as historic Cold War-era sites (USAF, 2006). Only one of the buildings proposed for CSM Demonstration use is identified as a Cold War site (Table 3-7).

**Table 3-7. Cold War Sites Potentially Affected by CSM Demonstration Activities at Vandenberg AFB, CA**

Facility	NRHP Eligibility	Contributing Elements
Integration Refurbishment Facility (Building 1900)	Eligible	None

Source: Carucci, 2009; USAF, 2006.

### 3.1.4.3 Native American Traditional Resources

At the time of sustained European contact in the early 1800s, the Vandenberg AFB area was occupied by inhabitants who spoke one of the major languages of the Chumashan branch of the Hokan language family. Several villages were located in the area that is now North Vandenberg AFB (USAF, 1998).

Today, Chumash-related traditional resources at Vandenberg AFB consist of both Traditional Cultural Properties and “traditional resource areas.” Known Traditional Cultural Properties on base include sacred sites, rock art sites, archaeological sites, and ancestral burial locations. The traditional resource areas on base are those locations that modern-day Native Americans access to collect raw materials (e.g., reeds, plants, minerals, and rock resources) or other items of interest. Preservation of this cultural and natural record is important to the living Chumash because of their respect for ancestors, ancestral lands, and traditional resources, as well as the importance of perpetuating Chumash society and traditional ways (MDA, 2009).

Although various traditional resources are located on Vandenberg AFB, none of these sites are within the ROI for proposed CSM Demonstration activities.

### **3.1.5 COASTAL ZONE MANAGEMENT**

Federal activity in, or affecting, a coastal zone requires preparation of a Coastal Zone Consistency Determination or a Negative Determination, in accordance with the Federal Coastal Zone Management Act (CZMA) of 1972. The California Coastal Zone Management Program was formed through the California Coastal Act (CCA) of 1976. The policies established by the CCA are similar to those for the CZMA. The CCA policies include the protection and expansion of public access and recreation; the protection, enhancement, and restoration of environmentally sensitive areas; protection of agricultural lands; the protection of scenic beauty; the facilitation of energy producing facilities; and the protection of property and life from coastal hazards. The CCC is responsible for reviewing Federally authorized projects for consistency with the California Coastal Zone Management Program (CCC, 2007).

At Vandenberg AFB, the coastal zone extends seaward out to the 3-nmi state water limit, and inland approximately 0.75 mi at the northern base boundary to approximately 4.5 mi at the southern end of the base (NOAA, 2004; VAFB, 2005a). The ROI for the Proposed Action includes those on- and off-base areas within the coastal zone that could be affected by project-related activities. This would include the TP-01 launch facility and Building 1806, which is one of the alternate PPFs (see Figure 2-3). No other buildings or facilities proposed for CSM Demonstration operations are located within the coastal zone. Because of launch-related noise and range safety evacuation procedures, local public beaches just north of Vandenberg AFB are also within the ROI.

### **3.1.6 WATER RESOURCES**

The State Water Resources Control Board and the nine Regional Water Quality Control Boards (RWQCBs) administer the Federal Clean Water Act and State water regulations in California. For Vandenberg AFB, the Central Coast RWQCB is the local agency responsible for development and enforcement of water quality objectives and implementation plans.

At Vandenberg AFB, the ROI for water resources includes those surface water features and groundwater that could be adversely affected by CSM Demonstration facilities or activities (e.g., drainage alteration or water quality degradation).

#### **3.1.6.1 Surface Water**

The Santa Ynez River and San Antonio Creek are the two major surface water features on Vandenberg AFB. There are also several small streams and tributaries that flow intermittently, mostly in response to rainfall events (refer to Figure 3-2). Additionally, numerous ponds, wetlands, and other water-holding depressions are found on the base. Rainfall at Vandenberg AFB is relatively light, averaging from 13 to 16 inches (33 to 41 cm) per year (VAFB, 2005a).

Because of its location in the San Antonio Terrace, a peneplain of low relief, TP-01 is within 1,000 ft (305 m) of large wetland areas. There are no prominent surface water features in proximity of TP-01 or the other CSM Demonstration support facilities. None of the facilities and construction areas are located within the 100-year floodplain (VAFB, 2004, 2005a, 2009b).

#### **3.1.6.2 Groundwater**

Most groundwater on Vandenberg AFB is found in the San Antonio Creek basin, which underlies the northern part of Vandenberg AFB. Smaller, isolated aquifers are found beneath alluvial fans or in perched aquifers at higher elevations (MDA, 2007b).

At TP-01, perched groundwater at the site has been observed between 10 and 25 ft (3 and 8 m) in depth (VAFB, 2005b). Groundwater has not been a concern at the other CSM Demonstration facilities.

### 3.1.6.3 Water Quality

The Vandenberg AFB water supply comes primarily from water provided by the CA Central Coast Water Authority and from four wells tapped into the San Antonio Creek groundwater basin. The wells are a supplemental water source used only a few weeks per year. Groundwater quality has decreased slightly in the region due to irrigation. The base water treatment plant, however, treats the water to meet all water quality requirements of the Federal Safe Drinking Water Act and State drinking water standards. Vandenberg AFB monitors the existing water distribution system for various water quality constituents on a routine basis (MDA, 2007b; USAF, 2005; VAFB, 2005a, 2007b).

### 3.1.7 HEALTH AND SAFETY

Regarding health and safety at Vandenberg AFB, the ROI is limited to the existing base facilities supporting the CSM Demonstration flight test, off-base areas within launch hazard zones, and areas downrange along the launch vehicle's flight path. The health and safety ROI includes base personnel, contractors, and the general public.

Air Force Policy Directive 91-2 (*Safety Programs*) establishes the USAF's key safety policies and also describes success-oriented feedback and performance metrics to measure policy implementation. More specific safety and safety-related DoD requirements, Air Force Instructions (AFIs), and other requirements and procedures pertaining to the handling, maintenance, transportation, and storage of rocket motors, and related ordnance, are listed below:

- DoD 6055.09-STD (*DoD Ammunition and Explosives Safety Standards*)
- AFI 91-202, Air Force Space Command (AFSPC) Supplement 1 (*The US Air Force Mishap Prevention Program*)
- Air Force Manual 91-201 (*Explosives Safety Standards*).

Health and safety requirements at Vandenberg AFB include industrial hygiene, which is the joint responsibility of Bio-Environmental Services and the 30 Space Wing (SW) Safety Office. These responsibilities include monitoring worker exposure to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations. Ground safety includes both occupational and public safety. Both AFOSH and applicable OSHA regulations and standards are used to implement safety and health requirements for all workers on base, including military personnel and contractors.

Final responsibility and authority for the safe conduct of ballistic and space vehicle operations lies with the 30 SW Commander. Establishing and managing the overall safety program is the responsibility of the 30 SW Safety Office, which ensures safety during launch operations at Vandenberg AFB.

The AFSPC Manual 91-710 (*Range Safety User Requirements*) establishes range safety policy, and defines requirements and procedures for ballistic and space vehicle operations at Vandenberg AFB (AFSPC, 2004). Over-ocean launches must comply with DoD Instruction 4540.01 (*Use of International Airspace by US Military Aircraft and for Missile/Projectile Firings*).

Prior to conducting rocket launches, all launch operations are evaluated by the 30 SW Safety Office to ensure that populated areas, critical range assets, and civilian property susceptible to damage are outside predicted impact/debris limits. These actions include a review of flight trajectories and hazard area dimensions, and review and approval of destruct systems. Criteria used to determine launch debris hazard risks are in accordance with the RCC Standard 321-07, *Common Risk Criteria Standards for National Test Ranges* (RCC, 2007).

Atmospheric dispersal modeling is also conducted to ensure emission concentrations from each launch do not exceed certain levels outside controlled areas. In accordance with 30 Space Wing Instruction (SWI) 91-106 (*Toxic Hazard Assessments*), if hydrogen chloride (HCl) launch emission cloud concentrations of 10 ppm or higher are predicted to cross the base land boundary, then the launch is postponed until meteorological conditions improve.

A NOTMAR and a NOTAM are published and circulated in accordance with 30 SWI 91-104 (*Operations Hazard Notice*) to warn personnel to avoid potential impact areas within established range Warning Areas off the coast, and in other international waters and airspace. Resources such as radar, ground roving security forces, and/or helicopter support are used prior to operations to ensure evacuation of non-critical personnel. Nearby access roads may be closed, and nearby recreational areas may be evacuated. For example, Ocean Beach County Park, between North and South Base, is closed on average three times per year under agreement with Santa Barbara County. Also under agreement with the Santa Barbara County and the State of California, Point Sal State Beach, at the northern end of the base, is closed on average 12 times a year (Ornelaz, 2009).

In accordance with 30 SWI 91-105 (*Evacuating or Sheltering of Personnel on Offshore Oil Rigs*), the USAF notifies oilrig companies of an upcoming launch event approximately 10 to 15 days in advance. The USAF's notification, provided through the Department of the Interior's Minerals Management Service, requests that the oilrigs located in the path of the launch vehicle overflight temporarily suspend operations and evacuate or shelter their personnel.

The coordination and monitoring of train traffic passing through the base during hazardous operations is conducted in accordance with 30 SWI 91-103 (*Train Hold Criteria*). An average of 10 trains pass through the base daily on the Union Pacific line (VAFB, 2005a, 2007d).

Vandenberg AFB possesses significant emergency response capabilities that include its own Fire Department, Disaster Control Group, and Security Police Force, in addition to contracted support for handling accidental releases of regulated hypergolic propellants and other hazardous substances.

The Vandenberg AFB Fire Department approves and maintains the business plans and hazardous material inventories prescribed by the CA Health and Safety Code. The plans and inventories are developed by the organizations conducting business on the base. Additionally, the base Fire Department conducts on-site facility inspections, as required, to identify potentially-hazardous conditions that could lead to an accidental release. During launch operations, Fire Department response elements are pre-positioned to expedite response in the event of a launch anomaly (USAF, 2006).

### **3.1.8 HAZARDOUS MATERIALS AND WASTE MANAGEMENT**

For the analysis of hazardous materials and waste management at Vandenberg AFB, the ROI is defined as those CSM Demonstration support facilities that: (1) store and handle hazardous materials; (2) collect, store (on a short-term basis), and ship hazardous waste; and (3) are located near existing Installation Restoration Program (IRP) sites or other contamination.

Hazardous materials and waste management activities at USAF installations are governed by specific environmental regulations. For the purposes of the following discussion, the term “hazardous materials or hazardous waste” refers to those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC Section 9601-9675, as amended. In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to the public health, welfare, or the environment when released. Regulated under the Resource Conservation and Recovery Act (RCRA), 42 USC Section 6901-6991, hazardous waste is further defined in 40 CFR 261.3 as any solid waste that possesses any of the hazardous characteristics of toxicity, ignitability, corrosiveness, or reactivity.

AFI 32-7042 (*Solid and Hazardous Waste Compliance*) and AFI 32-7086 (AFSPC Supplement 1) (*Hazardous Materials Management*) specify requirements for the development of procedures to manage hazardous materials and waste. In accordance with AFI 32-4002 (*Hazardous Materials Emergency Response Program*), each USAF installation must also develop a hazardous materials emergency response plan and procedures. These plans and procedures also incorporate appropriate Federal, state, local, and USAF requirements regarding the management of hazardous materials and hazardous waste, including pollution prevention.

On Vandenberg AFB, Air Force organizations are required to manage hazardous materials through the base’s HazMart Pharmacy. The HazMart is the single point of control and accountability for the requisitioning, receipt, distribution, issue, and reissue of hazardous materials. Hazardous materials obtained from off base suppliers are also coordinated through Vandenberg AFB’s HazMart Pharmacy. Hazardous materials are inventoried, tracked, and reported using the standardized Air Force HAZMAT Tracking System. These procedures are in accordance with the base *Hazardous Materials Management Plan* (30 SW Plan 32-7086).

The prevention, control, and handling of any spills of hazardous materials are covered under Vandenberg’s *Spill Prevention, Control and Countermeasures Plan* (30 SW 32-4002-C) and *Hazardous Materials Emergency Response Plan* (30 SW Plan 32-4002-A). These plans ensure that adequate and appropriate guidance, policies, and protocols regarding hazardous material spill prevention, spill incidents, and associated emergency response are available to all installation personnel.

For hazardous waste, the base *Hazardous Waste Management Plan* (30 SW Plan 32-7043-A) describes the procedures for packaging, handling, transporting, and disposing of such wastes. If not reused or recycled, hazardous wastes are transported off base for appropriate treatment and disposal. Industrial wastewaters (including rain and wash water collected from launch pad catchments) are monitored and properly disposed of in accordance with the Vandenberg AFB *Wastewater Management Plan* (30 SW Plan 32-7041-A). All hazardous wastes are managed in accordance with RCRA requirements and with CA Hazardous Waste Control Laws. The transportation of hazardous materials and waste outside the base boundaries is governed by US DOT regulations within 49 CFR 100-199.

As for IRP-related issues, no concerns have been identified at TP-01, the proposed CSM Demonstration launch site (MDA, 2009). There are no asbestos or lead-based paint (LBP) issues at TP-01 (VAFB, 2006). Other older buildings proposed for CSM Demonstration activities could contain hazardous materials used in their construction, such as asbestos and LBP. At Vandenberg AFB, LBP and asbestos are managed in accordance with 30 SW Plan 32-1002 (*Lead-Based Paint Management Plan*), 30 SW Plan 32-1052-A (*Asbestos Management Plan*), 32-1052-B (*Asbestos Operating Plan*), and other applicable Federal, state, local, and USAF requirements.

## **3.2 OVER-OCEAN FLIGHT CORRIDOR AND THE GLOBAL ENVIRONMENT**

Because of the potential global effects of launching rockets over the ocean and through the earth's atmosphere, this EA also considers the environmental effects on the global environment in accordance with the requirements of Executive Order 12114. This section describes the baseline conditions within the CSM Demonstration over-ocean flight corridor that may be affected by the Proposed Action.

### **Rationale for Environmental Resources Analyzed**

Because of the limited scope of the Proposed Action in the over-ocean flight corridor, the global atmosphere and the biological resources within the North Pacific were the only resource areas analyzed. Water quality and noise were also included in the analysis to account for potential impacts on marine life and some terrestrial (island) wildlife. Other environmental resources within the ROI were not evaluated in this EA because: (1) effects would be limited to the over-ocean flight corridor, thus, there is no potential for impacts to cultural resources, land use, soils, and groundwater; and (2) since the ROI is well removed from population centers, no impacts to socioeconomics, utilities, waste management, or transportation are anticipated, nor are environmental justice (Executive Order 12898) concerns expected. Although not discussed in these sections, health and safety-related issues in the flight corridor are addressed under Vandenberg AFB (Sections 3.1.7), and under USAKA/RTS and the Marshall Islands (Sections 3.3.4).

### **3.2.1 GLOBAL ATMOSPHERE**

#### **3.2.1.1 Stratospheric Ozone Layer**

The stratosphere, which extends from 6 mi (10 km) to approximately 30 mi (50 km) in altitude, contains the Earth's ozone layer (National Oceanic and Atmospheric Administration [NOAA], 2008). The ozone layer plays a vital role in absorbing harmful ultraviolet radiation from the sun. Over the last 20 years, anthropogenic (human-made) gases released into the atmosphere—primarily chlorine (Cl) related substances—have threatened ozone concentrations in the stratosphere. Such materials include chlorofluorocarbons (CFCs), which have been widely used in electronics and refrigeration systems, and the lesser-used Halons, which are extremely effective fire extinguishing agents. Once released, the motions of the atmosphere mix the gases worldwide until they reach the stratosphere, where ultraviolet radiation releases their Cl and bromine components.

Through global compliance with the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer and amendments, the worldwide production of CFCs and other ozone-depleting substances has been drastically reduced and banned in many countries. A continuation of these compliance efforts is expected to allow for a slow recovery of the ozone layer (World Meteorological Organization [WMO], 2006).

#### **3.2.1.2 Greenhouse Gases and Global Warming**

GHG are components of the atmosphere that contribute to the greenhouse effect and global warming. Several forms of GHG occur naturally in the atmosphere, while others result from human activities, such as the burning of fossil fuels. Federal agencies, states, and local communities address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions. According to the Kyoto Protocol and the California Climate Action Registry, there are six GHGs: carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (CARB, 2009b; United Nations Framework Convention on Climate Change [UNFCCC], 2008). Although the direct GHG (CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O) occur naturally in the atmosphere, human activities have changed GHG atmospheric concentrations. From the pre-industrial era (i.e., ending about

1750) to 2004, concentrations of CO<sub>2</sub> have increased globally by 35 percent. Within the US, fuel combustion accounted for 94 percent of all CO<sub>2</sub> emissions released in 2005. On a global scale, fossil fuel combustion added approximately 30 x 10<sup>9</sup> tons (27 x 10<sup>9</sup> metric tons) of CO<sub>2</sub> to the atmosphere in 2004, of which the US accounted for about 22 percent (USEPA, 2007).

Since 1900, the Earth's average surface air temperature has increased by about 1.2° to 1.4° Fahrenheit (F) (0.7° to 0.8° Celsius [C]). The warmest global average temperatures on record have all occurred within the past 15 years, with the warmest 2 years being 1998 and 2005 (USEPA, 2009). With this in mind, the USAF is supporting climate-changing initiatives globally, while preserving military operations, sustainability, and readiness by working, where possible, to reduce GHG emissions.

### **3.2.2 BIOLOGICAL RESOURCES**

The affected environment for the over-ocean flight corridor is described in the following subsections in terms of its environmental setting, threatened and endangered species, and other protected species. For purposes of this analysis, the ROI is focused primarily on the CSM Demonstration flight corridor over the North Pacific Ocean, where sonic booms and rocket motor drop zones might occur.

#### **3.2.2.1 Open-Ocean Environments**

The average ocean depth within much of the ROI is over 10,000 ft (3,056 m). Marine biological communities in the deep ocean waters can be divided into two broad categories: pelagic and benthic. Pelagic communities live in the water column and have little or no association with the bottom, while benthic communities live within, upon, or are otherwise associated with the bottom. The organisms living in pelagic communities may be drifters (plankton) or swimmers (nekton). The plankton consists of plant-like organisms (phytoplankton) and animals (zooplankton) that drift with the ocean currents, with little ability to move through the water on their own. The nekton consists of animals that can swim freely in the ocean, such as fish, squids, sea turtles, and marine mammals. Benthic communities are made up of marine organisms that live on or near the sea floor, such as bottom dwelling fish, shrimps, worms, snails, and starfish.

The North Pacific Ocean contains a number of threatened, endangered, and other protected species, including whales and small cetaceans, pinnipeds, and sea turtles. These are listed in Table 3-8 for ocean areas within the ROI. Many of these species can be found off the West Coast of the US or near the Hawaiian Islands, but they are sometimes seasonal in occurrence because of unique migration patterns. Some species, particularly the larger cetaceans, can occur hundreds or thousands of miles from land. For most of the ROI, there are no accurate population estimates or migratory routes for listed marine mammal species.

In the marine environment, there are many different sources of noise, both natural and anthropogenic. Biologically produced sounds include whale songs, dolphin clicks, and fish vocalizations. Natural geophysical sources include wind-generated waves, earthquakes, precipitation, and lightning storms. Anthropogenic sounds are generated by a variety of activities, including commercial shipping, geophysical surveys, oil drilling and production, dredging and construction, sonar systems, DoD test activities and training maneuvers, and oceanographic research (USAF, 2006).

While measurements for sound pressure levels in air are referenced to 20 µPa, underwater sound levels are normalized to 1 µPa at 3.3 ft (1 m) away from the source, a standard used in underwater sound measurement. Within the ROI, some of the loudest underwater sounds generated are most likely to originate from storms, ships, and some marine mammals. The sound of thunder from lightning strikes

**Table 3-8. Protected Marine Mammal and Sea Turtle Species  
Occurring within the North Pacific Over-Ocean Flight Corridor**

Common Name	Scientific Name	Federal Status
<b>Pinnipeds</b>		
Northern fur seal	<i>Callorhinus ursinus</i>	MMPA
Guadalupe fur seal	<i>Arctocephalus townsendi</i>	T
California sea lion	<i>Zalophus californianus</i>	MMPA
Pacific harbor seal	<i>Phoca vitulina richardsi</i>	MMPA
Northern elephant seal	<i>Mirounga angustirostris</i>	MMPA
Steller sea lion	<i>Eumetopias jubatus</i>	E
Hawaiian monk seal	<i>Monachus schauinslandi</i>	E
<b>Small Cetaceans</b>		
Harbor porpoise	<i>Phocoena phocoena</i>	MMPA
Dall's porpoise	<i>Phocoenoides dalli</i>	MMPA
Bottlenose dolphin	<i>Tursiops truncatus</i>	MMPA
Common dolphin	<i>Delphinus delphis</i>	MMPA
Spinner dolphin	<i>Stenella longirostris</i>	MMPA
Striped dolphin	<i>Stenella coeruleoalba</i>	MMPA
Northern right whale dolphin	<i>Lissodelphis borealis</i>	MMPA
Risso's dolphin	<i>Grampus griseus</i>	MMPA
Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>	MMPA
Pantropical spotted dolphin	<i>Stenella attenuata</i>	MMPA
Rough-toothed dolphin	<i>Steno bredanensis</i>	MMPA
Fraser's dolphin	<i>Lagenodelphis hosei</i>	MMPA
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	MMPA
Killer whale	<i>Orcinus orca</i>	MMPA
False killer whale	<i>Pseudorca crassidens</i>	MMPA
Pygmy killer whale	<i>Feresa attenuata</i>	MMPA
Dwarf sperm whale	<i>Kogia sima</i>	MMPA
Pygmy sperm whale	<i>Kogia breviceps</i>	MMPA
Melon-headed whale	<i>Peponocephala electra</i>	MMPA
<b>Beaked Whales</b>		
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	MMPA
Longman's beaked whale	<i>Indopacetus pacificus</i>	MMPA
Blainsville's beaked whale	<i>Mesoplodon densirostris</i>	MMPA
<b>Large Odontocetes and Baleen Whales</b>		
Sperm whale	<i>Physeter macrocephalus</i>	E
Gray whale	<i>Eschrichtius robustus</i>	MMPA
Humpback whale	<i>Megaptera novaeangliae</i>	E
North Pacific right whale	<i>Eubalaena japonica</i>	E
Sei whale	<i>Balaenoptera borealis</i>	E
Blue whale	<i>Balaenoptera musculus</i>	E
Fin whale	<i>Balaenoptera physalus</i>	E
Bryde's whale	<i>Balaenoptera edeni</i>	MMPA
Minke whale	<i>Balaenoptera acutorostrata</i>	MMPA



**Table 3-8. Protected Marine Mammal and Sea Turtle Species Occurring within the North Pacific Over-Ocean Flight Corridor (cont'd)**

Common Name	Scientific Name	Federal Status
<b>Sea Turtles</b>		
Green sea turtle	<i>Chelonia mydas</i>	T
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	E
Loggerhead sea turtle	<i>Caretta caretta</i>	T
Olive ridley sea turtle	<i>Lepidochelys oliveacea</i>	T
Leatherback sea turtle	<i>Dermochelys coriacea</i>	E

Notes:

MMPA = Protected under the Marine Mammal Protection Act

E = Endangered

T = Threatened

Source: NOAA, 2009a; USAF, 2006.

can have source levels of up to 260 dB (re to 1  $\mu$ Pa). A passing supertanker can generate up to 190 dB (re to 1  $\mu$ Pa) of low frequency sound. For marine mammals, dolphins are known to produce brief echolocation signals over 225 dB (re to 1  $\mu$ Pa), while mature sperm whale clicks have been calculated as high as 232 dB (re to 1  $\mu$ Pa) (USAF, 2006).

### 3.2.2.2 Atoll and Island Environments

Along the CSM Demonstration over-ocean flight corridor, the ROI includes those land areas that could potentially be affected by the resulting sonic boom. Similarly to the HTV-2 (Mission A) flight test previously analyzed in the HTV-2 EA (USAF, 2009b), the CSM Demonstration flight test could affect the NWHI (see Figure 2-4).

The NWHI are a remote chain of atolls, islands, and shoals that stretch for more than 1,000 nmi (1,852 km) northwest of the main Hawaiian Islands. The NWHI—now part of the Papahānaumokuākea Marine National Monument, the largest marine conservation area in the world—contains abundant plant, bird, and marine life. The monument was established in 2006 by Presidential Proclamation 8031 to protect marine resources in the area including coral reefs, the endangered Hawaiian monk seal, and various threatened and endangered sea turtle species (71 FR 36443-36474; NOAA, 2009b).

The Proclamation requires that all activities and exercises of the Armed Forces must be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on the Papahānaumokuākea Marine National Monument resources and qualities. It also states that the prohibitions required by the Proclamation will not apply to those military activities and exercises that are consistent with applicable laws (71 FR 36443-36474). The proposed CSM Demonstration flight test over the monument would be consistent with these requirements; thus, the test activities would be exempt from the Proclamation's prohibitions.

Within the NWHI, the areas that could potentially be affected by the sonic boom are Maro Reef, Gardner Pinnacles, Brooks Banks, and French Frigate Shoals, which are all located in the central portion of the island chain. The only dry land in this area consists of small rocky pinnacles and numerous sand islands located mostly within the French Frigate Shoals. The Shoals is the most important breeding and nesting area for the green sea turtle in the entire Hawaiian archipelago. As much as 80 percent of all green sea turtles in the entire Hawaiian archipelago return to French Frigate Shoals to nest and breed. The majority

of the world's population of Hawaiian monk seals is found in the NWHI where critical habitat has been designated. The French Frigate Shoals is one of several main breeding sites for Monk seals, and they have also been observed at Gardner Pinnacles and Maro Reef. The Shoals is also home to millions of migratory birds. On one island alone, an estimated 1.5 million sooty terns nest and breed (NMFS, 2007; NOAA, 2009c).

### **3.3 US ARMY KWAJALEIN ATOLL/REAGAN TEST SITE AND THE MARSHALL ISLANDS**

The RMI is located approximately 2,000 nmi (3,706 km) southwest of Hawaii (see Figure 2-4) and consists of approximately 1225 islets in 29 atolls scattered over 750,000 square mi (1,942,500 square km) (RMI Embassy, 2005). Centrally located within the RMI (see Figure 2-5), USAKA/RTS consists of all or portions of 11 out of 93 coral islets that enclose a large lagoon. Since the late 1950s, the Kwajalein Atoll has served as a primary site for flight testing ICBMs, sea-launched ballistic missiles, and antiballistic missiles.

Because of the Compact of Free Association between the RMI and the US, all US Government activities at USAKA/RTS must conform to specific compliance requirements, coordination procedures, and environmental standards identified in the UES. As specified in Section 2-2 of the UES, these standards also apply to all USAKA/RTS activities occurring elsewhere within the RMI, including the territorial waters<sup>6</sup> of the RMI (USASMDC/ARSTRAT, 2009). Thus, all CSM Demonstration actions proposed to occur at USAKA/RTS and within the RMI territorial waters must comply with the UES.

#### **Rationale for Environmental Resources Analyzed**

For the proposed CSM Demonstration flight test activities within the Marshall Islands, air quality, noise, biological resources, health and safety, and hazardous materials and waste management are the only resource areas analyzed. Water quality was also included in the analysis to account for potential impacts on marine life. Other resource topics were not analyzed further in this area because: (1) the Proposed Action requires minimal ground-disturbing activities at Illeginni Islet, thus no impacts to soils would be expected; (2) no important historical or archaeological resources have been identified on Illeginni Islet in proximity to the proposed impact site (USAF, 2004; USAKA, 2006b), thus no cultural resources would be harmed; (3) mostly existing base personnel would be involved, thus, there are no socioeconomic concerns; (4) through avoidance of high altitude jet routes (USASMDC/ARSTRAT, 2007) and the application of existing USAKA/RTS range safety procedures, there would be no major impacts on airspace; and (5) the Proposed Action is well within the limits of current operations at USAKA/RTS. As a result, there would be no adverse effects on land use, utilities, solid waste management, or transportation.

#### **3.3.1 AIR QUALITY**

Dominant during much of the year, trade winds at USAKA/RTS effectively disperse air emissions from the islets. Winds are generally from the northeast at 9 to 16 mph (14.5 to 26 kph). The summer months, however, can bring relatively calm conditions (USAKA, 2006a).

Air quality at USAKA/RTS is defined with respect to compliance with ambient air quality standards established in the UES, which are designed to maintain the current air quality at USAKA/RTS. As part of the UES standards and procedures, air pollutant threshold limits are set for major stationary sources and

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<sup>6</sup> Territorial waters of the RMI are defined as the belt of ocean measured from the seaward low-water line of the RMI reef and extending seaward a distance of 12 nmi (22 km) (USASMDC/ARSTRAT, 2009).

the USAKA Command is required to maintain an inventory of air pollutants from stationary sources, including criteria pollutants (except ozone), VOCs, and listed HAPs. Because of the relatively small numbers and types of air-pollution sources, the dispersal of emissions by trade winds, and the lack of topographic features that inhibit dispersion, air quality at USAKA/RTS is considered good overall (USASMDC/ARSTRAT, 2009). Unlike the continental US, tropospheric ozone is not a concern.

The primary sources and activities at USAKA/RTS contributing to air pollution are power generators, incineration of solid waste, storage and handling of fuel, transportation (ground vehicles, vessels, and aircraft), and occasional rocket launches and missile tests (USASMDC/ARSTRAT, 2009). There are limited industry operations (e.g., sand blasting and painting) and very few motor vehicles on the islets. The majority of emissions are from combustion sources that produce particulates, NO<sub>x</sub>, SO<sub>2</sub>, CO, and hydrocarbon emissions. For the analysis of air quality at USAKA/RTS, the ROI is limited to those islet-based activities and operations in support of the Proposed Action, which would occur primarily at Illeginni Islet.

Emission sources at Illeginni Islet, an uninhabited islet, are much more limited and sporadic than on the inhabited islets of USAKA/RTS (e.g., Kwajalein Islet). Other than occasional vessel or helicopter trips to Illeginni for maintenance and security purposes, and the burning of UXO a few times a year at the UXO burn pit on the far west end of the islet, there are minimal activities and emission sources on the islet.

ICBM reentry vehicle flight tests at Illeginni Islet—as described and analyzed in the MM-III EA (USAF, 2004)—have occurred on average once every 4 or 5 years. As a result of the prior flight tests, some residual concentrations of Be and DU might remain in the soil on the west side of the islet. Both Be and DU can present toxicity health concerns, primarily when inhaled as HAPs. Although DU also has some radioactive properties, it is not a radiological health concern.<sup>7</sup> Long-term environmental sampling and monitoring of the reentry vehicle tests, however, have shown that air quality standards for Be (40 CFR 61.32) and uranium (U) (10 CFR Part 20, Appendix B) have not exceeded the UES standards.<sup>8</sup> For the test period of 1989 to 2006, air concentrations of both Be and U at Illeginni Islet were lower than the most restrictive US guidelines (for the general public) by a factor of 10,000, thus presenting no health-related concerns (Robison et al., 2006).

### 3.3.2 NOISE

During terminal flight and impact at USAKA/RTS, the PDV has the potential to affect land areas with sonic booms. Thus, the ROI for noise is focused primarily on those RMI atolls and islets closest to the CSM Demonstration flight path. For the land impact Preferred Alternative flight path, Kwajalein, Likiep, Ailuk, Taka, and Utirik Atolls, as well as Jemo Islet, might be affected (see Figure 2-5). For the BOA impact Alternative flight path, Bikar, Taka, and Utirik Atolls might be affected. Census records from 1999 indicate 527 residents on Likiep Atoll, 513 on Ailuk Atoll, 433 on Utirik Atoll; and none on Bikar and Taka Atolls or on Jemo Islet (RMI Economic Policy, Planning, and Statistics Office [EPPSO], 2005). Kwajalein Atoll has the highest population within the ROI with a total population of approximately 12,500, including US personnel and Marshallese residents (EPPSO, 2005; Hibberts, 2009).

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<sup>7</sup> Natural U is a silver-colored metal that is radioactive and nearly twice as dense as lead. Small amounts of U naturally occurring in soil, water, air, plants, and animals contribute to natural background radiation in the environment. DU is a byproduct of the enrichment process used to make weapons grade U-235. DU retains the natural toxicological properties of U, but has approximately half of its radiological activity. DU is a non-fissile material. (USAF, 2004)

<sup>8</sup> For Be, the ambient air concentration limit is 0.01 micrograms [ $\mu\text{g}$ ] per cubic m, averaged over 30 days. For DU (as derived from U-238), the annual limit on intake (by inhalation for occupational exposure) is  $6 \times 10^{-10}$  micro Curies per milliliter (USASMDC/ARSTRAT, 2009).

Natural sources of noise on these remote atolls include the constant wave action along shorelines and the occasional thunderstorm. The sound of thunder, one of the loudest sounds expected here, can register up to 120 dB (Vavrek et al., 2008). Within the atoll communities, other sources of noise include a limited number of motor vehicles, motorized equipment, and the occasional fixed-wing aircraft at the Utirik airfield. Typical daytime noise levels within the local communities are expected to range between 55 and 65 dBA (USASSDC, 1993). Ambient noise levels at USAKA/RTS are slightly greater because of higher levels of equipment, vehicle, and aircraft operations. On Kwajalein Islet, for example, there are several aircraft flights per week, including military and commercial jet aircraft.

UES policies for noise management specify conformance with the US Army's Environmental Noise Management Program and noise monitoring provisions as specified in Army Regulation 200-1 (*Environmental Protection and Enhancement*). As an Army installation, USAKA/RTS also implements the Army's Hearing Conservation Program as described in Department of the Army Pamphlet 40-501 (*Hearing Conservation Program*). Army standards require hearing protection whenever a person is exposed to steady-state noise greater than 85 A-weighted decibels (dBA), or impulse noise greater than 140 dB, regardless of duration. Army regulations also require personal hearing protection when using noise-hazardous machinery or entering hazardous noise areas.

### 3.3.3 BIOLOGICAL RESOURCES

The UES provides protection for a wide variety of marine mammals, sea turtles, fish, coral species, migratory birds, and other terrestrial and marine species, which are listed in Section 3-4 of the UES (USASMDC/ARSTRAT, 2009). This protection applies to all of the following categories of biological resources occurring within the Marshall Islands, including RMI territorial waters:

- Any threatened or endangered species listed under the US ESA
- Any species proposed for designation, candidates for designation, or petitioned for designation to the endangered species list in accordance with the US ESA
- All species designated by the RMI under applicable RMI statutes, such as the RMI Endangered Species Act of 1975, Marine Mammal Protection Act of 1990, Marine Resources (*Trochus*) Act of 1983, and the Marine Resources Authority Act of 1989
- Marine mammals designated under the US Marine Mammal Protection Act of 1972
- Bird species pursuant to the Migratory Bird Conservation Act (MBCA)
- Species protected by the Convention on International Trade in Endangered Species, or mutually agreed on by USAKA/RTS, USFWS, NMFS, and the RMI Government as being designated as protected species (USASMDC/ARSTRAT, 2009).

For purposes of this analysis, the ROI focused on: (1) the RMI atolls, islets, and BOA that could be affected by the PDV sonic booms; and (2) the alternative impact sites for the PDV at USAKA/RTS (on Illeginni Islet and within the BOA). The following subsections describe biological resources for marine and terrestrial environments within the ROI according to the environmental setting, important habitats, and the threatened, endangered, or other protected species that might be present.

### 3.3.3.1 Atoll and Islet Environments

#### Remote Atolls and Islets

For terrestrial and reef-related biological resources, the ROI for the land impact Preferred Alternative flight path includes Likiep, Ailuk, Taka, and Utirik Atolls, as well as Jemo Islet (see Figure 2-5). For the BOA Alternative flight path, the ROI consists of Bikar, Taka, and Utirik Atolls. As previously described in the HTV-2 EA (USAF, 2009b), some of the remote atolls and islets in this region of the Northern Marshall Islands are relatively undisturbed and present unique ecosystems for migratory birds, sea turtles, and other marine species. A list of protected and other special status species potentially occurring in these areas is provided in Appendix B.

Because of the pristine environments, and diverse range of habitats, sea and shore birds, sea turtles, and reef species, Bikar Atoll, Taka Atoll, and Jemo Islet have been nominated for United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Site designation (UNESCO, 2009). In addition, other reports recommend the protection of Bikar Atoll as a National Preserve, Jemo Islet as a Wildlife Reserve/Sanctuary for nesting sea turtles, and Taka Atoll as a National Park (RMI Office of Environmental Planning and Policy Coordination [OEPPC], 2008).

#### Kwajalein Atoll

Kwajalein Atoll consists of 93 coral islets with a total land area of 6.3 square mi (16.3 square km) that enclose a large lagoon (RMI Embassy, 2005). Lagoon depths are typically 120 to 180 ft (37 to 55 m), although numerous coral heads approach or break the surface (USAF, 2004). While the larger islets have been almost completely altered by development and a variety of exotic species introduced, many of the smaller islets remain relatively undisturbed with native forest. Up to 36 species of migratory seabirds, shorebirds, and other birds have been reported on the atoll, and seabird nesting activity has been observed on many of the islets. Several threatened and endangered species of sea turtles can be found in the lagoon and ocean waters surrounding the atoll, and sea turtle nesting has occurred on several of the islets (RMI OEPPC, 2008; USFWS/NMFS, 2006). Other protected and special status marine species occurring at Kwajalein Atoll include certain marine mammals, fishes, corals, sponges, and mollusks (see Appendix B).

No designated essential fish habitat is identified at Kwajalein Atoll or elsewhere in the Marshall Islands; however, approximately 250 species of reef fish are found in the atolls. Because food cultivation on the islets is limited, fish and other sea life are an important dietary source of food to the Marshallese people. In an effort to protect the fisheries, the multilateral fisheries agreement between the United States and South Pacific island governments, including the Marshall Islands, have adopted a treaty (United Nations Agreement on Highly Migratory Fish Stocks and Straddling Fish Stocks) that promotes the long-term sustainable use of highly migratory species, such as tuna, by balancing the interests of coastal states and states whose vessels fish on the high seas (USAF, 2004).

In accordance with requirements specified in the UES, USAKA/RTS must conduct a natural resource baseline survey every 2 years to identify and inventory protected or significant fish, wildlife, and habitat resources (USASMD/ARSTRAT, 2009). In providing support to USAKA/RTS, USFWS and NMFS personnel normally conduct the biennial biological resource inventories at all islets leased from the RMI, which includes those areas on and adjacent to Illeginni Islet. These surveys were initiated in 1996 and continue to be conducted on a regular basis every 2 years. The last surveys were conducted in 2006 and in 2008; however, the survey reports for these two years have not yet been released. The descriptions of biological resources provided in the paragraphs that follow are based largely on the 2004 and earlier surveys conducted by the USFWS and NMFS.

## Illeginni Islet

Within Kwajalein Atoll, Illeginni Islet is one of 11 islets leased to the United States for USAKA/RTS operations. Located on the west-central side of the atoll, Illeginni Islet is 31 acres (12.5 hectares) of land area with several buildings (some abandoned), towers, roads, a helipad, and a dredged harbor area. Illeginni Islet also has terrestrial and marine habitats of significant biological importance, as defined in the UES and shown on Figure 3-4. Islet vegetation is managed on much of the western end of the island and around buildings/facilities. Native vegetation present on the islet consists of one patch of herbaceous strand and three patches of littoral (near shore) forest. The forest areas are made up primarily of *Pisonia*, *Intsia*, *Tournefortia*, and *Guetarda* trees. Some littoral shrub land can also be found mostly on the western end of the islet (USFWS/NMFS, 2006; USASSDC, 1993).

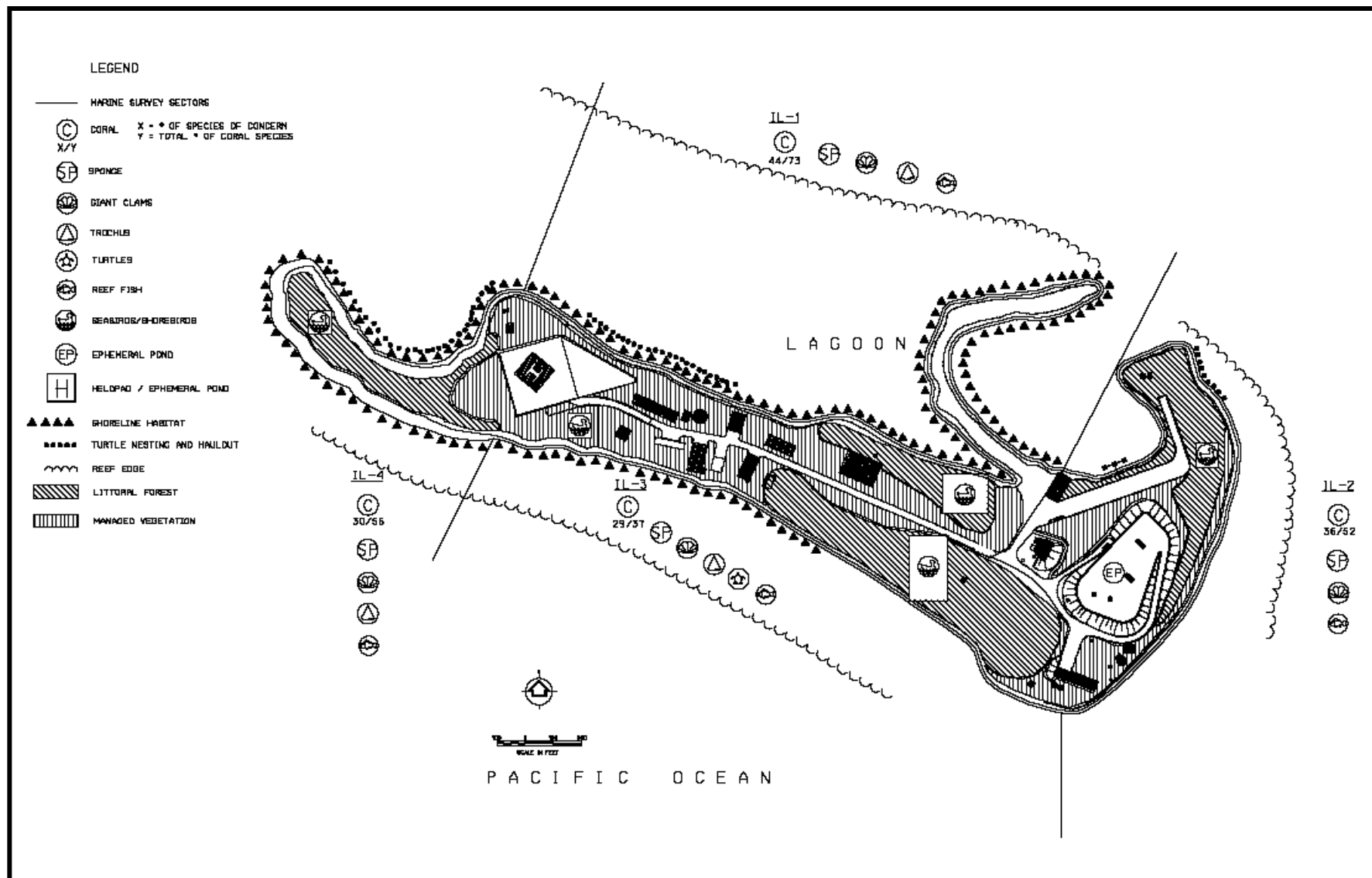
A number of protected migratory seabirds and shorebirds have been seen either breeding, roosting, or foraging on Illeginni Islet. Between 1998 and 2004, biological inventories conducted on the islet by the USFWS and NMFS have identified at least 14 bird species, including the black noddy, pacific golden plover, wandering tattler, and ruddy turnstone. Migratory birds protected under the MBCA within USAKA receive protection under the UES. None of these species, however, are currently listed as protected under the US ESA. Surveys have shown shorebirds to use the managed vegetation throughout the islet's interior (Figure 3-4). Pooled water on the paved areas attracts both wintering shorebirds and some seabirds (e.g., terns, plovers, and curlews). White terns have been observed in trees at the northwest corner and southwest quadrant of the islet. The shoreline embankment and exposed inner reef provides a roosting habitat for great crested terns and black-naped terns. Concentrations of seabirds have also been seen in the littoral forest on the southeast side of the islet, which supports the second largest nesting colony of black noddies recorded on the USAKA/RTS-leased islets; nearly 150 nests were identified in 2000. There are also signs of black-naped tern nesting on the western tip of the islet. In general, the nesting season for migratory seabirds and shorebirds at Illeginni and other USAKA/RTS islets begins in October and continues through April. Exceptions include white terns, which may nest throughout the year (Foster, 2009; USAF, 2004; USFWS/NMFS, 2006).

Other terrestrial species observed on Illeginni include rats and three species of ants. These non-native species were accidentally introduced to the islet some years earlier (USAF, 2004; USFWS/NMFS, 2006).

As shown in Figure 3-4, suitable sea turtle haul-out/nesting habitat exists along the shoreline on the northwestern and eastern sides of Illeginni. In 1996, three sea turtle nesting pits were found on the northwestern tip of Illeginni Islet. No pits were observed during the 1998, 2000, 2002, or 2004 biological inventories; however, the habitat still appeared suitable for successful nesting. On a few occasions, adult hawksbill and green sea turtles have been seen in the waters offshore. Within Kwajalein Atoll, nesting for both hawksbill and green sea turtles has been observed to occur throughout the year (Foster, 2009; USAF, 2004; USFWS/NMFS, 2006).

Immediately northwest of Illeginni Islet are interislet reef flats that extend for approximately 2.0 mi (3.2 km). Along these flats, within 0.25 mi of Illeginni, is a small unnamed islet that is less than an acre in size and covered primarily with littoral shrub land and a few trees. Southeast of Illeginni Islet about 0.8 mi (1.3 km) away is Onemak Islet, which is a larger islet that is heavily forested throughout (see Figure 4-4). Although no known biological surveys have been conducted on these adjacent islets, it is expected that a variety of sea and shore birds use these areas for nesting, feeding, and resting. Sea turtle haul-out and nesting habitat may also occur along the shorelines of these neighboring islets.

The marine environment surrounding Illeginni Islet supports a diverse community of corals, fish, and invertebrates, including the following protected species: mollusks, such as top shell snails (*Trochus*



Source: USFWS/NMFS, 2006

Figure 3-4. Biological Resources at Illeginni Island, USAKA/RTS

species) and the black-lip mother of pearl oyster (*Pinctada margaritifera*); close to 20 species of sponges; and at least 73 species of hard corals. Some of the reef fish species observed in the area include surgeonfishes, snappers, groupers grey reef sharks, and parrotfishes. Figure 3-4 shows areas where sensitive marine habitats and protected species generally occur at Illeginni Islet. Based on prior surveys conducted around the islet, coral cover is moderate to high off the north and east sides of the islet, and lower off the west side. South of the islet, coral diversity and abundance is low. Severe physical impacts in this area have disrupted the coral community landward of the reef crest. In addition to the water column being turbid in this area, reef rubble and metal fragments from legacy iron piers and dump sites widely cover the benthic substrate (Robison et al., 2005; USAF, 2004; USFWS/NMFS, 2006).

On the ocean side of the atoll, marine mammals have occasionally been seen and/or heard (underwater clicking sounds) in the vicinity of Illeginni Islet. In 2000, a pod of approximately 12 endangered sperm whales was seen a few miles southeast of Illeginni. In 2006, two sperm whales and eight pilot whales were observed in the area. More recently, in April 2009, an estimated four sperm whales were sighted a few miles southeast of Illeginni (Madore, 2007; Malone, 2009; USFWS/NMFS, 2002, 2006).

### **3.3.3.2 Broad Ocean Area Environments**

For biological resources in deep ocean waters, the ROI focuses on the BOA Alternative flight test impact site located north of USAKA/RTS. The ROI also includes other international ocean areas and territorial waters of the RMI that might be affected by the PDV sonic booms.

Ocean depths in this region of the RMI generally range between 6,560 and 16,400 ft (2000 and 5000 m) (Hein et al., 1999). Just as described for the open-ocean environment in Section 3.2.2.1, there is a wide variety of pelagic and benthic communities in the BOA. A number of threatened, endangered, and other protected species occur here, including whales, small cetaceans, and sea turtles. These are listed in Appendix B for the ROI. Some of these species occur only seasonally for breeding or because of unique migration patterns.

As described in Section 3.2.2.1, there are many different sources of noise in the marine environment, both natural and anthropogenic. Within the ROI, some of the loudest underwater sounds generated are most likely to originate from storms, ships, and some marine mammals.

### **3.3.4 HEALTH AND SAFETY**

For the CSM Demonstration flight test, USAKA/RTS would provide range support for the terminal phase of flight. At USAKA/RTS and elsewhere within the RMI, there would be no requirements or issues related to launch safety, launch hazards, or rocket propellant handling. Thus, the ROI for health and safety focuses on the PDV alternative flight paths and impact areas, and includes consideration of military personnel, contractors, and the general public.

USAKA/RTS has the unique mission of serving as the target area for a wide variety of missile launch operations from Vandenberg AFB, CA, and from the Pacific Missile Range Facility in Hawaii. All program operations must first receive the approval of the Safety Office at USAKA/RTS. This step is accomplished through presentation of the proposed program to the Safety Office. All safety analyses, standard operating procedures, and other safety documentation applicable to those operations affecting the USAKA/RTS must be provided, along with an overview of mission objectives, support requirements, and schedule. The Safety Office evaluates this information and ensures that all USAKA/RTS range safety requirements (including both ground and flight safety) and supporting regulations are followed. Final responsibility and authority for the safe conduct of missile and flight test operations lies with the USAKA/RTS Commander (USASMDC/ARSTRAT, 2007).



Range safety provides protection to USAKA/RTS personnel, inhabitants of the Marshall Islands, and ships and aircraft operating in areas potentially affected by missions. Specific procedures are required for the preparation and execution of missions involving aircraft, missile launches, and reentry payloads like the CSM Demonstration. These procedures are based on regulations, directives, and flight safety plans for individual missions. The flight safety plans include evaluating risks to inhabitants and property near the flight path, calculating trajectory and debris areas, and specifying range clearance and notification procedures (USASMDC/ARSTRAT, 2007). Criteria used at USAKA/RTS to determine debris hazard risks are in accordance with RCC Standard 321-07, *Common Risk Criteria Standards for National Test Ranges* (RCC, 2007).

Inhabitants near the flight path, as well as air and sea traffic in caution areas designated for specific missions, are notified of potentially hazardous operations. As described earlier for Vandenberg AFB, a NOTMAR and a NOTAM are transmitted to appropriate authorities to clear traffic from these caution areas and to inform the public of impending missions. The warning messages describe the time, the area affected, and safe alternate routes. The RMI Government is also informed in advance of rocket launches and reentry payload missions. USAKA/RTS radar and/or visual sweeps of hazard areas are accomplished immediately prior to operations to assist in the clearance of non-mission ships and aircraft. For terminal flight tests conducted within the Mid-Atoll Corridor Impact Area at USAKA/RTS (see Figure 2-5)—such as for the Preferred Alternative—a number of additional precautions are taken to protect personnel and the general public. Such precautions may consist of evacuating nonessential personnel and sheltering all other personnel remaining within the Mid-Atoll Corridor (USAF, 2004; USASMDC/ARSTRAT, 2007).

### 3.3.5 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

For the analysis of hazardous materials and waste management at USAKA/RTS, the ROI is defined as those CSM Demonstration test areas and support facilities that: (1) store and handle hazardous materials; (2) collect, store (on a short-term basis), and ship hazardous waste; and (3) are located near existing contaminated sites.

Regulations governing hazardous material and hazardous waste management at USAKA/RTS are specified in the UES (USASMDC/ARSTRAT, 2009). The UES classify all materials as either general-use, hazardous, petroleum products, or prohibited. The objective of the standards for material and waste management is to identify, classify, and manage in an environmentally responsible way all materials imported or introduced for use at USAKA/RTS.

Commonly used hazardous materials (e.g., cleaning solvents, paints, and petroleum products) are managed and distributed through the contractor-operated general supply system. Tenants, construction contractors, program offices, and other recipients importing activity-specific hazardous materials to USAKA/RTS are required to submit—within 15 days of receiving the material or before actual use, whichever comes first—a separate Hazardous Materials Procedure to the Garrison Commander for approval. Such procedures outline requirements for material storage, use, transportation, and eventual disposal.

As a requirement of the UES, the Army has prepared the *Kwajalein Environmental Emergency Plan* (KEEP) for responding to releases of oil, hazardous material, pollutants, and other contaminants into the environment (USAKA/RTS, 2003). The KEEP is substantively similar to the spill prevention, control, and countermeasure plan often required in the United States. As part of the KEEP, a *Hazardous Materials Management Plan* (HMMP) has been prepared to address USAKA's import, use, handling, and disposal of hazardous materials. This Plan includes maintaining an inventory of hazardous materials routinely imported and used at USAKA. As part of pollution prevention, recycling, and waste

minimization activities, each revision of the HMMP includes both a description of the steps taken to reduce the volume and toxicity of the generated waste, and a description of the changes in volume and toxicity of waste achieved since the last revision.

Hazardous or toxic waste treatment or disposal is not allowed at USAKA/RTS under the UES. Hazardous waste, whether generated by range activities or range users, is handled in accordance with the procedures specified in the UES. Hazardous wastes are collected at individual work sites in waste containers. Containers are kept at the point of generation accumulation site until they are full, or until a specified time limit is reached. Containers are then collected from the generation point and transported to the USAKA/RTS Hazardous Waste 90-Day Storage Facility on Kwajalein Islet. Wastes are then shipped off-islet by barge for treatment and disposal in the continental United States.

Although there are several abandoned buildings on Illeginni Islet, the USAKA/RTS has removed all remaining hazardous materials and wastes (e.g., asbestos, polychlorinated biphenyls [PCBs] in old light ballasts, and cans of paint) from these facilities (USAF, 2004). Range personnel using the UXO burn pit on the far west side of the islet also ensure that all UXO is consumed with each burn operation.

As described in Section 3.3.1, some residual concentrations of Be and DU might remain in the soil on the western side of Illeginni Islet—a result of prior ICBM reentry vehicle tests. In 2005, Lawrence Livermore National Laboratory (LLNL) analyzed over 100 soil samples collected on the western side of the islet to determine concentrations of Be and DU in the soil (Robison et al., 2006). A summary of the concentration results are presented in Table 3-9.

<b>Table 3-9. Concentrations of Beryllium and Uranium in Soil at Illeginni Islet, USAKA/RTS</b>		
<b>Concentration</b>	<b>Be (μg/g)</b>	<b>U (μg/g)</b>
Median	0.22	6.5
Mean	1.6	24
Standard Deviation	3.4	6.6
Standard Error	0.32	6.1

Source: Robison, 2006

Based on the soil analysis conducted by LLNL, concentrations of Be and U on Illeginni Islet are statistically similar to the natural background concentrations found in soils on other coral atolls in the northern Marshall Islands and at other global locations (Robison, 2005, 2006). The observed soil concentrations of Be and DU on Illeginni Islet, thus are well within compliance with USEPA Region 9 Preliminary Remediation Goals as outlined in the UES.<sup>8</sup>

<sup>8</sup> For Be, the goal is set at 150 milligrams (mg)/kg (residential). For DU (as U), the goal is set at 200 mg/kg (industrial) (USASMD/ARSTRAT, 2009).

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## 4.0 ENVIRONMENTAL CONSEQUENCES

This chapter presents the potential environmental consequences of the Proposed Action and No Action Alternative, described in Chapter 2.0 of this EA, when compared to the affected environment described in Chapter 3.0. The amount of detail presented in each section of the analysis is proportional to the potential for impact. Both *direct* and *indirect* impacts<sup>9</sup> are addressed where applicable. In addition, *cumulative* effects that might occur are identified in Section 4.3. Appropriate environmental management and monitoring actions and requirements are also included in this chapter, where necessary, and summarized in Section 4.4. A list of all agencies, organizations, and personnel consulted as part of this analysis is provided in Chapter 6.0.

### 4.1 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

The following subsections describe the potential environmental consequences of implementing the Proposed Action at Vandenberg AFB, within the over-ocean flight corridor, and at USAKA/RTS in the Marshall Islands. Environmental issues associated with the proposed CSM Demonstration flight test vary widely at each location, and as such, the resources analyzed at each location also vary. A breakdown of the resources analyzed in detail, by location, is shown in Table 4-1, along with the section numbers where the respective discussions are found.

**Table 4-1. Resources Analyzed in Detail by Location**

Location	Air Quality	Noise	Biological Resources	Cultural Resources	Coastal Zone Management	Water Resources	Health & Safety	Hazardous Materials & Waste Mgt
Vandenberg AFB	Sect. 4.1.1.1	Sect. 4.1.1.2	Sect. 4.1.1.3	Sect. 4.1.1.4	Sect. 4.1.1.5	Sect. 4.1.1.6	Sect. 4.1.1.7	Sect. 4.1.1.8
Over-Ocean Flight Corridor and the Global Environment	Sect. 4.1.2.1 <sup>1</sup>		Sect. 4.1.2.2					
USAKA/RTS and the Marshall Islands	Sect. 4.1.3.1	Sect. 4.1.3.2	Sect. 4.1.3.3				Sect. 4.1.3.4	Sect. 4.1.3.5

<sup>1</sup> Air quality in this environmental setting focuses on the stratospheric ozone layer and GHS within the Global Atmosphere.

Various management controls and engineering systems are in place at Vandenberg AFB and at USAKA/RTS to manage and implement environmental and safety requirements. Required by Federal, state, DoD, and agency-specific regulations, these measures are implemented through normal operating procedures. To help ensure that procedures are followed, base personnel and contractors receive periodic training on applicable environmental and safety requirements. In addition, environmental audits by both internal offices and external agencies are conducted at the installations to verify compliance.

<sup>9</sup> *Direct* impacts are caused by the action and occur at the same time and place. *Indirect* impacts occur later in time or are further removed in distance, but are still reasonably foreseeable.

#### 4.1.1 VANDENBERG AIR FORCE BASE

##### 4.1.1.1 Air Quality

Although short-term minor adverse effects to air quality would be expected with the implementation of the Proposed Action, the overall impacts would be insignificant. The total direct and indirect emissions would not exceed *de minimis* (minimal importance) thresholds, be regionally significant, or contribute to a violation of Vandenberg AFB's air operating permits.

The general conformity rules require Federal agencies to determine whether their action(s) would increase emissions of criteria pollutants above preset threshold levels (40 CFR 93.153). These *de minimis* rates vary depending on the severity of the nonattainment and geographic location. Because Santa Barbara County is an attainment area for all NAAQS, the general conformity rules do not apply (40 CFR 93; SBCAPCD Rule 702). For the purposes of this EA, however, these threshold levels were used to determine whether implementation of the Proposed Action would be significant under NEPA. The *de minimis* levels of 100 tons per year (tpy) for all criteria pollutants were used for comparison purposes.

The total direct and indirect emissions associated with the Proposed Action were estimated and would not exceed *de minimis* levels (Table 4-2). Because AQCR 032 and Santa Barbara County are an attainment area, there are no existing emission budgets. Due to the limited size and scope of the Proposed Action, it is not anticipated that the estimated emission would make up 10 percent or more of regional emissions for any criteria pollutant and be regionally significant. Detailed methodologies for estimating the air emissions are described in Appendix C.

**Table 4-2. Estimated Emissions of Criteria Pollutants for the Proposed Action (Tons per Year)**

Activity/Source	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Site Modifications	0.59	0.87	0.13	0.001	0.05	0.05
Pre-Launch Preparations	0.64	0.16	0.08	0.001	0.01	0.01
Launch Activities <sup>1</sup>	19.65	0.01	0.00	0.002	3.08	2.15
Post-Launch Operations	0.07	0.01	0.01	0.000	0.00	0.00
<b>Total</b>	20.95	1.05	0.22	0.004	3.14	2.21
<i>De Minimis</i> Thresholds	100	100	100	100	100	100
<b>Exceeds <i>De Minimis</i> Threshold</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>

<sup>1</sup> PM<sub>10</sub> emissions from launch vehicle exhaust are assumed to be 10.3 percent total aluminum oxide (Al<sub>2</sub>O<sub>3</sub>), while PM<sub>2.5</sub> emissions are assumed to be 7.2 percent total Al<sub>2</sub>O<sub>3</sub> (USAF, 2004).

##### 4.1.1.1.1 Site Modifications and Pre-Launch Preparations

Site modifications would be minor and limited to TP-01. Facility modifications would not include any grading or open burning. No fugitive dust emissions are expected. For the site modifications and pre-launch preparations emissions shown in Table 4-2, all of the sources listed below were estimated for direct and indirect emissions of criteria pollutants. Detailed methodologies for estimating the air emissions are provided in Appendix C. Notably, emissions outlined herein represent conservative estimations of both the types of equipment to be used and the duration of activities. They can be considered the upper-bound of construction-related emissions.

- Combustive emissions from equipment used for TP-01 modifications and installation of a new fiber optic cable
- Emissions from transporting components, equipment, supplies, and services to Vandenberg AFB
- Employee commuting during facility modifications and pre-launch activities
- Emissions from transporting the CSM Demonstration launch vehicle and equipment to the launch site
- Use of solvents/paints/adhesives during launch vehicle integration

Proper tuning and preventive maintenance of vehicles and other support equipment would minimize engine exhaust emissions. In addition, site modifications and pre-launch preparations for the CSM Demonstration would be conducted in compliance with all applicable SBCAPCD rules and regulations, including those that cover the use of organic solvents (Rule 317), architectural coatings (Rule 323), surface coating of metal parts and products (Rule 330), surface coating of aircraft or aerospace parts and products (Rule 337), or adhesives and sealants (Rule 353) (SBCAPCD, 2009b). No hazardous liquid propellants, such as hydrazine, would be used as part of the Proposed Action. An emergency power portable generator provided by the launch contractor would be permitted by the SBCAPCD or registered under the CARB Portable Equipment Registration Program.

As a result, the proposed site modifications and pre-launch preparations requirements would not cause significant impacts on local or regional air quality.

#### 4.1.1.1.2 Launch Activities

Under the Proposed Action, only one flight test would occur. In the hours before the launch, remote sensors and helicopters (when available) may be used to verify that the hazard areas would be clear of non-mission-essential aircraft, vessels, and personnel. All direct and indirect emissions of criteria pollutants for the helicopter exhaust emissions and from the CSM Demonstration flight test were estimated (Table 4-2). In addition to criteria pollutants, the products of combustion from the Minotaur IV Lite booster would also include other common products of combustion including aluminum oxide, hydrogen chloride, hydrogen, nitrogen, carbon dioxide, and water. Table 4-3 provides a comprehensive breakdown of the booster emissions. Detailed methodologies for estimating air emissions during launch are provided in Appendix C.

<b>Table 4-3. Exhaust Emissions from a Minotaur IV Lite Booster Launch (Tons)</b>				
<b>Pollutant</b>	<b>1st Stage</b>	<b>2nd Stage</b>	<b>3rd Stage</b>	<b>Total</b>
Aluminum Oxide (solid) (Al <sub>2</sub> O <sub>3</sub> )	17.67	9.72	2.50	<b>29.89</b>
Carbon Monoxide (CO)	10.89	5.99	2.76	<b>19.65</b>
Carbon Dioxide (CO <sub>2</sub> )	1.20	0.66	0.13	<b>1.99</b>
Hydrogen Chloride (HCl)	10.44	5.74	0.12	<b>16.30</b>
Water (H <sub>2</sub> O)	3.67	2.02	0.25	<b>5.94</b>
Hydrogen (H <sub>2</sub> )	1.10	0.60	0.17	<b>1.88</b>
Nitrogen (N <sub>2</sub> )	4.13	2.27	1.89	<b>8.28</b>
Other miscellaneous	0.13	0.07	0.00	<b>0.21</b>

Source: SMC Det 12/RPD, 2005.

During boost flight, the rocket emissions from all stages would be rapidly dispersed over a large geographic area and by prevailing winds. The launch would be a short-term discrete event. Atmospheric concentrations of emissions would differ depending on local meteorological conditions at the time of launch, such as temperature profiles, atmospheric stability, wind speeds, and the presence or absence of inversions. No exceedance, however, of air quality standards or health-based standards for non-criteria pollutants would be anticipated. Launch activities would be conducted in compliance with all applicable SBCAPCD rules and regulations. As a result, no significant impacts on local or regional air quality are expected.

#### **4.1.1.1.3      *Post-Launch Operations***

In the hours and days following the launch, a general safety check and cleanup of the launch site would occur. All direct and indirect emissions of criteria pollutants for worker commuting, the removal of equipment from the launch site, and general refurbishment of the launch facility were estimated (see Table 4-2). Detailed methodologies for estimating air emissions for post-launch activities are provided in Appendix C. Post-launch refurbishment activities would comply with all applicable SBCAPCD rules and regulations, including Rule 323 (architectural coatings) for VOCs found in paints (SBCAPCD, 2009b). No new air emission permits would be required for these operations. With the exception of minor, localized increases in particulate matter from the brushing of blast residues from the launch stool, no significant impacts on local or regional air quality are expected.

#### **4.1.1.2      Noise**

##### **4.1.1.2.1      *Site Modifications and Pre-Launch Preparations***

Noise exposures from proposed modification activities on base are expected to be minimal and short term. Most of the site modification noise would occur at TP-01. The use of trucks, power tools, compressors, and other machinery would be expected to produce noise levels ranging from 85 to 104 dBA at close range (Suter, 2002).

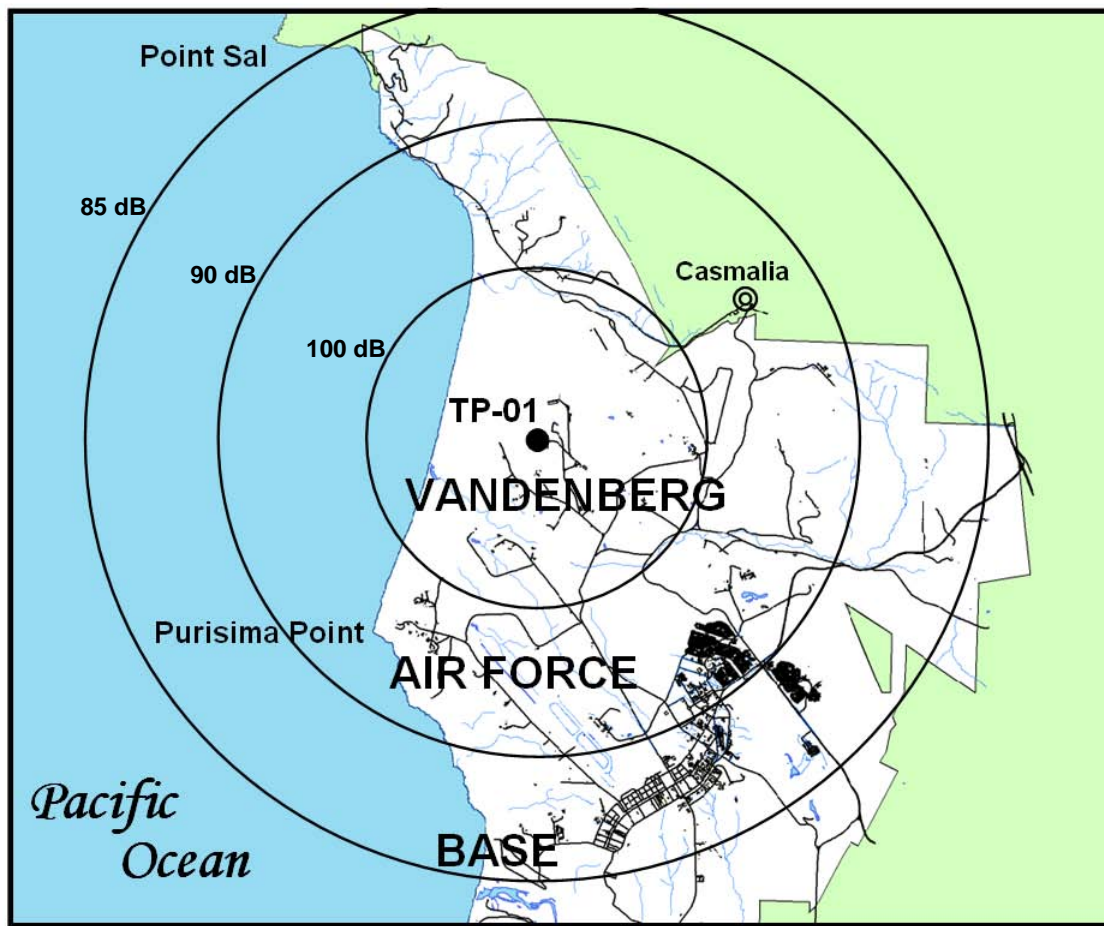
The noise generated during pre-launch preparations would come primarily from the use of trucks, cranes, and other load handling equipment. Noise levels from such operations would be expected to range between 84 and 100 dBA in the immediate area surrounding TP-01 (Suter, 2002).

For all of these actions, personnel would be required to comply with the USAF Hearing Conservation Program requirements (as described in Section 3.1.2) and other applicable occupational health and safety regulations. Because most of the activities would take place on base, the public in the surrounding communities would not detect an increase in noise levels.

As a result, the proposed site modifications and pre-launch preparations would not cause significant noise impacts.

##### **4.1.1.2.2      *Launch Activities***

Noise levels generated the CSM Demonstration launch would vary, depending on the launch trajectory used and the weather conditions during launch. At a distance of 1,000 ft (305 m) from the launch pad, the launch noise would be approximately 131 dB ASEL (Do, 1994). With increasing distance, the ASEL generated would decrease to around 85 dB nearly 8 mi (13 km) away. Figure 4-1 depicts the predicted maximum noise-level contours for the proposed Minotaur IV Lite vehicle launch from TP-01. The modeling results depicted in the figure represents a maximum predicted scenario that does not account for



Source: USAF, 2006

**Figure 4-1. Predicted A-Weighted Sound Exposure Levels for a Minotaur IV Lite Launch from Vandenberg AFB, CA**

variations in weather or terrain. Based on the modeling results, the cities of Santa Maria and Lompoc would be well outside the 85-dBA noise contour. For the small community of Casmalia, the launch from TP-01 would result in noise levels up to approximately 95 dB ASEL. Such noise levels, however, would be less than that of other prior launches from North Vandenberg AFB.

While these noise exposure levels can be characterized as very loud in some areas, they would occur infrequently, are very short in duration (about 20 seconds of intense sound per launch), and have little effect on the CNEL in these areas. Personnel working near the area at the time of launch would be required to wear adequate hearing protection in accordance with USAF Hearing Conservation Program requirements. If helicopters are used to verify that beach areas and near shore waters are clear of non-participants, then they would generally limit their flights to the areas around the base, thus also limiting the noise effects on local communities.

The sonic boom generated by the Minotaur IV Lite launch vehicle would occur down range, well off the CA Coast. Flight trajectories would be in a westerly direction (Figure 2-3), and as such, the resulting sonic boom would be inaudible over coastal areas, including the northern Channel Islands. Although sonic boom data for the Minotaur IV Lite vehicle is unavailable, it is expected that the resulting



overpressures would be considerably less than the 7.2 psf expected from the much larger Atlas V system launched from South Vandenberg (USAF, 2000). Typically, the sonic boom would last no more than a few hundred milliseconds.

As a result, no significant impacts on the human environment are expected from launch noise or sonic booms. For discussions of potential impacts on protected wildlife species, refer to Sections 4.1.1.3 and 4.1.2.2.

#### **4.1.1.2.3      *Post-Launch Operations***

Noise levels generated during post-launch operations would be similar to those generated during pre-launch preparations, but for a shorter duration. Thus, no impacts to ambient noise levels are expected.

#### **4.1.1.3      *Biological Resources***

Because the proposed CSM Demonstration pre-launch preparations and launch activities at Vandenberg AFB have the potential to adversely affect Federally listed threatened and endangered species, base biologists prepared a BA to evaluate the potential for impacts on the endangered ESBB and the threatened California red-legged frog (VAFB, 2009b). In October 2009, Vandenberg AFB submitted the BA to the USFWS in request for formal consultation in accordance with Section 7 of the ESA. In response, the USFWS provided the USAF a BO on the effects of the Proposed Action on the ESBB and California red-legged frog at Vandenberg AFB. A copy of the USFWS BO is provided in Appendix D of this EA. Further discussions on the results of the consultations are included in the following sections.

##### **4.1.1.3.1      *Site Modifications and Pre-Launch Preparations***

At Vandenberg AFB, noise from the movement of trucks and other load-handling equipment would have minimal affects on wildlife. These activities would be relatively short-term and intermittent, and the vehicles and other equipment would normally remain on paved or gravel areas. Although the activities and noise levels might cause some species of birds and mammals to leave the immediate area, the activities are not expected to have a noticeable effect on local wildlife populations.

At TP-01, the vegetation is overgrown after years of disuse, necessitating heavy brush removal and mowing inside and outside the existing security fence within 20 ft (6 m) of the fence line. A total of approximately 1.5 acres (0.6 hectares) would be cleared around the pad to reestablish the firebreak. A second firebreak would also be created southeast of TP-01 by cutting back and mowing a control line from the end of the Rhea Road turn-around to the existing railroad track—an area of approximately 0.2 acres (0.1 hectares) to be cleared of vegetation. Field surveys of the TP-01 pad perimeter area to be mowed identified the presence 369 seaciff buckwheat plants—the Federally endangered ESBB’s host plant (Tetra Tech, 2007; VAFB, 2009b). Only four seaciff buckwheat plants were found along the proposed firebreak at the end of the Rhea Road turn-around (VAFB, 2009b). Maintenance and installation of the new fiber optic cable along Rhea Road would also require vegetation disturbance within 5 ft (1.5 m) of the road shoulder; however, the seaciff buckwheat plants that grew along the road have since been mowed. As a result of the disturbance and removal of 373 seaciff buckwheat plants around TP-01 and at the Rhea Road firebreak, as well as the recent removal of seaciff buckwheat plants along Rhea Road, the USFWS agreed with Vandenberg AFB’s BA that the loss of ESBB habitat “may affect and is likely to adversely affect” the ESBB because all life-cycle stages of the butterfly may be harmed. To compensate for potential impacts to ESBB individuals and loss of habitat, the USFWS BO in Appendix D identifies several measures to be implemented as part of the Proposed Action, including those listed below. By implementing these measures, the USFWS concluded that the activities would not jeopardize the continued existence of the ESBB.

- A qualified biologist, familiar with seaciff buckwheat would survey the project footprint and place flags where avoidance of individual plants is feasible during general construction activities.
- Initial clearing of vegetation for the firebreaks would occur outside of the ESBB flight season (June 1 through September 15).
- The Vandenberg AFB Environmental Office would provide a training session for all project workers prior to beginning work. Training would address Federally listed species and their habitats in the project area.
- Vandenberg AFB would remove 1 acre (0.4 hectare) of ice plant (*Carpobrotus spp.*) in the vicinity of Wall Beach and plant 1,000 seaciff buckwheat seedlings during the rainy season.

There is no aquatic habitat for California red-legged frogs in the immediate project area; however, red-legged frogs could be present in the project area during migration or dispersal. Thus, any frogs in the proposed firebreak areas or along Rhea Road could be injured or killed by worker foot traffic and off-road vehicles. As a result, the USFWS determined that the Proposed Action may have an “adverse effect” on California red-legged frogs. To minimize such effects on the species, the USFWS BO in Appendix D identifies several measures to be implemented as part of the Proposed Action, including those listed below. By implementing these measures, the USFWS concluded that the activities would not jeopardize the continued existence of the California red-legged frog.

- A qualified biologist, familiar with the California red-legged frog, would survey the project area before construction work begins. If any California red-legged frogs are found, they would be captured and relocated out of harm’s way and within the same watershed.
- Project activities that occur during the breeding season (November through March) must occur during daylight hours, unless a Service-approved biologist is on-site to survey for California red-legged frogs during all nighttime project activities.
- Any exposed trenches would be covered or ramped at the end of each work day to prevent wildlife from becoming trapped.
- The Vandenberg AFB Environmental Office would provide a training session for all project workers prior to beginning work. Training would address Federally listed species and their habitats in the project area.

Overall, it is expected that site modifications and pre-launch preparations would not have a significant effect on local vegetation and wildlife, because: (1) noise exposures from these activities generally would be short term and localized around existing facilities and along roadways; and (2) limited areas around TP-01 and along Rhea Road would be disturbed. For these same reasons, and through compliance with the USFWS BO, the proposed activities are not expected to have a significant impact on threatened or endangered species or other sensitive habitats.

#### **4.1.1.3.2 Launch Activities**

Potential issues associated with CSM Demonstration launch operations at Vandenberg AFB include wildlife responses to helicopter overflights (if conducted), wildlife responses and potential injury from excessive launch noise, and the heat and release of potentially harmful chemicals from exhaust emissions. The release of unburned propellant from a possible launch failure or termination is also considered. The

potential effects of these actions on the biological resources at Vandenberg AFB are described in the paragraphs that follow.

## Vegetation

Ground-level heat and emissions generated by the rocket plume during initial launch have the potential to scorch nearby vegetation and cause foliar spotting. Reestablishment of the vegetation clear zone/firebreak around TP-01, however, would minimize impacts to surrounding vegetation. Such launch effects on vegetation caused by larger rocket systems have been shown to be temporary and not of sufficient intensity to cause long-term damage to vegetation (National Aeronautics and Space Administration [NASA], 2002; USAF, 2000). During launch operations, emergency firefighting personnel and equipment would be on standby status as a protective measure in case of brush fires.

## Wildlife

Helicopter Overflights. When available, base helicopters might be flown over the ROI on the day of launch and possibly the day before to ensure launch hazard areas are clear of unauthorized personnel. Helicopter overflights have the potential to disturb marine mammals and birds, causing separation of pinniped mothers from their offspring; potential loss of eggs when birds fly from nests; and abandonment of favored resting, feeding, or breeding areas.

Under the terms of the MMPA, as amended, short-term behavioral effects on marine mammals are considered. According to the MMPA, “harassment” means any act of “pursuit, torment, or annoyance” that has the potential to injure or disturb marine mammals or marine mammal stock.<sup>10</sup> The proposed CSM Demonstration launch and other system launches at Vandenberg AFB have the potential to harass marine mammals. To address this issue, base personnel consulted the NMFS to obtain a programmatic “take” permit to allow Level B Harassment on four pinniped species, including the Pacific harbor seal and the California sea lion. A 5-year take permit was originally issued to Vandenberg AFB in 1997, and was later re-issued in February 2004 and again in February 2009. Under the permit, the NMFS is allowed to issue annual Letters of Authorization (LOAs) to Vandenberg AFB for these harassments, which are classified as a small number of “takes” incidental to space vehicle and test flight activities. The programmatic take permit and LOAs allow the base to expose pinnipeds, including breeding harbor seals, to missile and rocket launches, and aircraft flight tests. They also authorize incidental harassment of pinnipeds from helicopter overflights (74 FR 6236-6244; USAF, 1997).

Prior observations of helicopter overflights in launch hazard areas have shown them to be a greater source of disturbance than the rocket launches (Bowles, 2000). Under the current NMFS permit and LOA, helicopters and other aircraft are required to maintain a minimum slant range of 1,000 ft (305 m) from recognized seal haul-outs and rookeries (see Figure 3-3), including Lion’s Head year round and Purisima Point from October through February only (74 FR 6236-6244; VAFB, 2007a). These requirements can be modified only in emergencies, such as during search-and-rescue and firefighting operations. When

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<sup>10</sup> Under the MMPA, two categories of harassment are defined: (a) the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment), and (b) disturbance to a marine mammal or marine mammal stock by causing disruption of natural behavioral patterns, e.g., migration, breathing, nursing, breeding, or feeding (Level B harassment). Prior rulings by NMFS, however, have determined that a momentary behavioral reaction of a protected marine mammal to an acoustic event that is both brief and isolated in time does not qualify as Level B harassment (US Department of the Navy [USN], 2008b). In addition, Section 319 of the National Defense Authorization Act of 2004 (Public Law 108-136) revised the definition of “harassment” in the MMPA (16 USC 1362(18)) as it applies to military readiness activities. Under the revised definitions, “Level A harassment” is “any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild.” Level B harassment is “any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered.”

helicopter flight restrictions are observed, there are negligible impacts on marine mammals and other wildlife.

Launch Noise. As previously analyzed in the OSP EA (USAF, 2006), noise generated by Minotaur IV launches from TP-01 may result in the incidental harassment of pinnipeds along the base shoreline. Launch noise levels at the Lion's Head and Purisima Point haul-outs, however, are not expected to exceed 95 dB ASEL. The noise and visual disturbances from the launch may cause pinnipeds to move towards or enter the water. Field surveys have shown that the louder the launch noise, the longer it took for seals to begin returning to the haul-out site and for the numbers to return to pre-launch levels. The NMFS has determined that rocket launches (and helicopter operations) at Vandenberg AFB result in no more than Level B harassment of Pacific harbor seals, California sea lions, and other pinnipeds. The effects are limited to short term and localized changes in behavior and a possible temporary threshold shift (TTS) in hearing for any pinnipeds that are in close proximity to a launch pad at the time of a launch. NMFS has also determined that any takes will have no more than a negligible impact on the affected species and stocks. No take by serious injury and/or death is anticipated and the potential for permanent hearing impairment (Permanent Threshold Shift [PTS]) is unlikely (74 FR 6236-6244; SRS Technologies [SRS], 2000, 2001).

The Minotaur IV Lite flight trajectory from TP-01 would be in a westerly direction (Figure 2-3); thus, the resulting sonic boom likely would not be audible in the northern Channel Islands. Because there would be no sonic boom of greater than 1 psf in the islands, there is no requirement to monitor pinniped haul-out sites on the islands (74 FR 6236-6244).

To minimize potential long-term effects of launch noise on pinnipeds, the programmatic take permit requires that several measures be implemented, including: (1) schedule missions, whenever possible, to avoid launches during the harbor seal pupping season (March 1 through June 30), unless constrained by factors including, but not limited to, human safety, national security, or for a space vehicle launch trajectory necessary to meet mission objectives; (2) conduct biological monitoring for all launches during the harbor seal pupping season in accordance with permit procedures, and report the results to the NMFS; and (3) conduct both acoustic and biological monitoring for all new space and missile launch vehicles during at least the first launch (including an existing vehicle from a new launch site), whether it occurs within the pupping season or not (74 FR 6236-6244). The proposed CSM Demonstration launch would be conducted in accordance with the measures specified in the programmatic take permit.

The marine mammal programmatic take permit covers a forecast of up to 30 space and missile launches per year at Vandenberg AFB (74 FR 6236-6244). The addition of one CSM Demonstration launch would not cause the forecast limit to be exceeded (refer to Section 4.3.1 for further discussions on this issue).

As for other non-listed species at Vandenberg AFB, any terrestrial mammals or birds in proximity to the launch might suffer startle responses and flee the area for a short period of time. These effects, however, would be temporary and are not expected to affect local population levels.

Because of the programmatic take permit measures already in place, and considering that only one CSM Demonstration launch is planned, no significant impacts to pinnipeds or to other non-listed wildlife species on base are expected to occur as a result of launch noise.

Launch Emissions and Plume Effects. The atmospheric deposition of launch emissions has the potential to acidify surface waters. The types and quantities of emissions products released from the Minotaur IV Lite booster are listed in Table 4-3. The principal combustion product of concern is HCl gas, which forms hydrochloric acid when combined with water.

The acidification of surface waters in some of the small drainages and wetland areas near the TP-01 launch site could present harmful conditions for aquatic wildlife and some protected species. The bedrock and, by inference, the soils at Vandenberg AFB do not contain large amounts of acid-neutralizing minerals. However, the proximity of the proposed launch site to the ocean, combined with the prevailing onshore winds, causes the deposition of acid-neutralizing sea salt. The alkalinity derived from sea salt should neutralize the acid falling on soil, thus eliminating the potential for acid runoff. Surface water monitoring conducted for larger launch systems on Vandenberg's South Base has not shown long-term acidification of surface waters (USAF, 2000).

Launch Failure or Early Flight Termination. In the unlikely event of a failure during launch, or an early termination of flight, the launch vehicle would most likely fall into the ocean reasonably intact, along with some scattered debris. Fragments of unburned solid propellant, which is composed of ammonium perchlorate, aluminum, and other materials, could be widely dispersed. Of particular concern is the ammonium perchlorate in the solid propellant resin binding-agent. Once the propellant enters the water, the ammonium perchlorate could slowly leach out and create toxic conditions for plants and animals. Laboratory studies, however, have shown that in freshwater at 68° F (20° C), the leaching of all perchlorate from solid propellant fragments can take many years, depending on the fragment weight (Lang et al., 2003). In lower water temperatures and/or in more saline (ocean) waters, perchlorate leaching rates become even slower (Fournier and Brady, 2005; Lang et al., 2002).

A lesser hazard may also exist from small amounts of battery electrolyte carried on the CSM Demonstration launch vehicle. The risks from electrolytes are far smaller than for propellants because of smaller quantities and the use of more rugged containment systems for batteries (NASA, 2002).

The probability of an aborted launch for a Minotaur IV Lite vehicle is very low. Historically, launch records indicate a 4 percent failure rate for similar Peacekeeper ICBM launch vehicles (SMC Det 12/RPD, 2006). If an early abort were to occur, then base actions would be taken immediately for the recovery and cleanup of unburned propellants and any other hazardous materials that had fallen on the beach, off the beach within 6 ft (1.8 m) of water, or in any freshwater creeks, retention ponds, and wetland areas. Recovery from deeper coastal waters would occur on a case-by-case basis. Because any solid propellants or flight batteries remaining in the offshore waters would be subject to constant wave action and currents, localized build-up of perchlorate concentrations or other contaminants is unlikely to occur.

As a result, launch-related activities are not expected to have a significant impact on wildlife.

### **Threatened and Endangered Species**

Those threatened and endangered species that potentially could be affected by the CSM Demonstration launch at Vandenberg AFB are listed in Table 3-5 and discussed in the paragraphs that follow. Although other listed species occur on Vandenberg AFB, their remoteness from the launch sites makes it unlikely that they would be adversely affected.

The Federally endangered Gaviota tarplant is reported to occur over a mile east of the TP-01 launch pad. At this distance, there is no risk for plants to be affected by the solid rocket motor emissions, including HCl deposition. Immediately following launch, the emissions would be rapidly dispersed and diluted over a large area. Thus, the launch is expected to have "no effect" on Gaviota tarplant.

During the flight season of the ESBB (June 1 through September 15), any ESBB individuals in proximity to a CSM Demonstration launch at TP-01 could be harmed or killed by the blast effects of the rocket motor. However, it is unlikely that any butterflies would be traveling across the large, open firebreak and

launch pad area during the brief launch event. Because the launch is currently scheduled to occur outside of the ESBB flight season in late 2012, it is expected that the blast would have “no effect” on the species.

It is possible that vernal pool fairy shrimp might occur in some of the wetland areas near TP-01. During launch, acidic exhaust products from the rocket motor could potentially cause a slight increase in water pH, affecting fairy shrimp survival. As described earlier, however, the constant deposition of wind-blown sea salt should eliminate the potential for water acidification. Because of this process and the brief life span of the fairy shrimp (3 to 7 weeks), risks to the population are minimal and the launch is expected to have “no effect” on the species.

As previously mentioned, there is no aquatic habitat for California red-legged frogs in the immediate area of TP-01; however, frogs could be present in the area during migration or dispersal. Although unlikely, any frogs in proximity of the launch pad during the brief launch event could be exposed to high launch noise levels (in excess of 131 dB ASEL in some cases) and the blast effects of the rocket motor. In their BA to the USFWS, Vandenberg AFB biologists determined that the CSM Demonstration launch “may affect, but is not likely to adversely affect” California red-legged frogs (VAFB, 2009b). However, to minimize the potential for adverse effects from the launch, the USFWS identified in their BO (Appendix D) that the USAF must use Service-approved biologists to conduct pre-activity surveys for red-legged frogs prior to the test launch. If a California red-legged frog is located in the action area, the biologist must relocate it to nearby suitable habitat out of harm’s way and within the same watershed.

In some years, a few nesting pairs of California least terns can be found along the southern end of Minuteman Beach, from San Antonio Creek south. During their nesting season (generally from April 15 to August 31), these seabirds could be startled by the brief noise and vision of a launch from TP-01. The proposed CSM Demonstration launch from TP-01, however, is not expected to have an adverse impact on the seabirds. Following their recent review, Vandenberg AFB biologists concluded that the CSM Demonstration launch would have “no effect” on the least terns because: (1) the launch window is scheduled for late 2012, outside of the least tern nesting season; (2) the launch vehicle would be at or near 25,000 ft (7,620 m) in altitude before it crosses over Minuteman Beach, which would minimize any noise or visual effects; and (3) numerous space and missile launch monitoring reports for this species have shown no significant impact from base operations (Evans, 2010).

On the coastal dunes along Minuteman Beach, western snowy plovers forage year round and nest from early March through September within 1.5 mi (2.4 km) of the TP-01 launch site. Even at this relatively close distance, however, the brief noise and vision of the proposed CSM Demonstration launch is not expected to have an adverse effect on this species. Just as for California least terns, Vandenberg biologists concluded that the CSM Demonstration launch would have “no effect” on snowy plovers for the same reasons discussed above (Evans, 2010).

Because helicopters and other aircraft can also disturb California least terns and western snowy plovers, Vandenberg AFB implemented requirements for all aircraft to maintain a slant range of not less than 1,900 ft (580 m) from nesting areas (from March 1 through September 30) at Purisima Point. A year-round minimum 500 ft (152 m) slant range is also required for snowy plover habitat areas located from Minuteman Beach south to Purisima Point (VAFB, 2007a). As described earlier for pinniped haul-outs and rookeries, these requirements can be modified only for emergency purposes. By observing these aircraft restrictions, it is expected that there would be “no effect” on the listed bird species.

As previously described, southern sea otter colonies are found in the offshore waters at Purisima Point. At a distance of 4.0 mi (6.4 km) from the TP-01 launch pad, the animals could be exposed to surface launch noise levels up to 95 dB ASEL. Monitoring data obtained during launches conducted at Vandenberg AFB since 1998 indicate that launch noise and helicopter overflights do not substantially

affect the number or activities of sea otters in the nearshore marine environment (VAFB, 2008b). Following their recent review, Vandenberg AFB biologists concluded that the CSM Demonstration launch would have “no effect” on southern sea otters (Evans, 2010).

In summary, the proposed CSM Demonstration launch operations may cause short-term effects on some threatened or endangered species. These actions, however, are not likely to adversely affect the long-term well being or survival of any of these species, thus no significant impacts are expected. The measures and monitoring requirements already in place at Vandenberg AFB, plus those identified in the USFWS BO, would be incorporated into the project operations to minimize potential impacts on listed species.

### **Environmentally Sensitive Habitats**

The California least tern and western snowy plover nesting areas along Minuteman Beach and at Purisima Point would be subjected to brief launch noise, but otherwise would not be affected by launch vehicle overflights. In the unlikely event that launch debris would fall within sensitive habitat areas, the base biologists would assist in recovery operations by surveying the impact area. Appropriate methods of recovery would be used that minimize surface disturbance (e.g., limited use of vehicles and heavy equipment).

Based upon earlier discussions, rocket launch emissions would not impact the water quality of local surface waters. If a launch anomaly were to occur, then actions at Vandenberg AFB would be taken immediately for the recovery and cleanup of unburned propellants, and any other hazardous materials that had fallen on the ground or in any of the freshwater creeks, retention ponds, wetlands, and shoreline areas. Recovery operations in deeper coastal waters, however, would be treated on a case-by-case basis. As a result, no significant impacts would occur to wetlands and other freshwater habitats on base, or to essential fish habitat in coastal waters.

#### **4.1.1.3.3 Post-Launch Operations**

The intermittent movement of trucks, cranes, and any cleanup/maintenance equipment would not produce substantial levels of noise, and vehicles would normally remain on paved or gravel areas. Thus, the limited actions associated with post-launch operations would have no significant impacts on local vegetation or wildlife, including threatened and endangered species, and other environmentally sensitive habitats.

#### **4.1.1.4 Cultural Resources**

In March/April 2008, the Vandenberg AFB Cultural Resources Office conducted a National Historic Preservation Act Section 106 consultation with the California SHPO for MDA's KEI program, which had previously proposed similar facility modifications and launches from TP-01, including the installation of a new fiber optic cable along existing roadways (MDA, 2009). The consultation completed for the KEI program determined that there would be No Adverse Effect from KEI activities. Because the proposed CSM Demonstration activities at TP-01 are similar to the early KEI program plans, the USAF concludes that a finding of No Adverse Effect for cultural resources is also appropriate for the proposed CSM Demonstration activities. Therefore, the base Cultural Resources Office does not anticipate the need to re-engage in consultations with the SHPO for the CSM Demonstration.

In December 2009, the Vandenberg AFB Cultural Resources Office initiated Section 106 consultations with the Santa Ynez Band of Chumash Indians. Following a visit to the TP-01 launch site by a Chumash representative in late March 2010, the Elders Council was briefed on the findings and concurred that the

proposed CSM Demonstration activities would not affect cultural resources on base (refer to Appendix A, page A-6).

#### **4.1.1.4.1 Site Modifications and Pre-Launch Preparations**

##### **Archaeological Sites**

To avoid potential impacts to archaeological sites during CSM Demonstration-related site modifications at TP-01, heavy equipment would remain on the TP-01 launch pad or on other paved areas when operating around the pad area. Construction staging would be located on existing paved areas to the east of the launch pad. In addition, disk harrows would not be used for vegetation clearing and maintenance of firebreaks.

Soil excavation would be limited to one new tower and/or pole off the east end of TP-01 and approximately 4,900 ft (1,494 m) of trenching along Rhea Road for the new fiber optic cable. To minimize potential impacts on any nearby archaeological sites, the fiber optic extension to TP-01 would be trenched in previously disturbed areas within 5 ft (1.5 m) of the road shoulder. If excavation work was to occur within 200 ft (61 m) of a known archaeological site, boundary testing would be required to ensure that portions of the site are not inadvertently disturbed. Any archaeological site or potential site where tested boundaries are within 100 ft (30 m) of the project would require monitoring by an archaeologist and/or Native American specialist during earth disturbing activities. In the unlikely event that previously undocumented sites are discovered during the execution of the Proposed Action, work would be temporarily suspended within 100 ft (30 m) of the discovered item and the base archaeologist would be notified immediately. Work would not resume until after the site had been secured and properly evaluated.

To reduce the risk of unauthorized artifact collection, personnel would not be informed of the location of nearby archaeological sites unless the sites are to be specifically avoided by CSM Demonstration activities. The base Cultural Resources Office would brief personnel, as necessary, on the sensitivity of cultural resources, applicable Federal regulations, and the mitigation measures that might be required if sites are inadvertently damaged or destroyed.

The Minotaur IV Lite vehicle integration and launch preparations represent routine types of activities at the base. In some situations, transportation activities could potentially harm subsurface resources when moving launch vehicle components and equipment to and from the launch pad and other facilities. So as not to risk disturbing archaeological sites, transport vehicles, cranes, and other load-handling equipment would remain on paved or gravel areas (no off-road travel).

Thus, no significant or other adverse impacts to archaeological sites are expected from site modifications and pre-launch preparations.

##### **Historic Buildings and Structures**

Booster processing for the CSM Demonstration would occur at the IRF (Building 1900). As previously described, the IRF has been determined to be eligible for listing on the NRHP for its Cold War, ICBM Program historic context. Project implementation, however, would not require any facility modifications to the IRF, and the types of activities proposed to occur in the building would be similar to that of the deactivated Peacekeeper ICBM support program. Additionally, the IRF was included in Historic American Engineering Record documentation related to the beddown of the Ground-Based Midcourse Defense system at Vandenberg AFB (US Army Corps of Engineers, 2003). Thus, no significant impacts to the IRF or any other historic structures are expected.



#### **4.1.1.4.2      *Launch Activities***

No ground disturbance or other facility modifications would occur during flight activities. Thus, no significant or other adverse impacts to archaeological sites or historic buildings/structures are expected from nominal flight activities.

Falling debris from a flight termination or other launch anomaly, however, could strike areas on the ground where surface or subsurface archaeological deposits or other cultural resources are located. Such an impact could result in soil contamination, fire, and/or resource damage—all of which requires a reparation effort. Firefighting activities could damage subsurface historic and prehistoric archaeological sites as well. In the unlikely event that a mishap occurs, post-mishap recommendations would include post-event surveying, mapping, photography, and site recordation to determine and record the extent of the damage. These efforts would be coordinated with applicable range representatives and the California SHPO to develop the most appropriate mitigation measures based on the nature of the mishap and the cultural resources involved. Any debris falling offshore would not pose a threat to cultural resources on base.

#### **4.1.1.4.3      *Post-Launch Operations***

Because of the limited activities associated with post-launch operations, no ground disturbance or other facility modifications would occur. CSM Demonstration and base personnel would be on site during cleanup and site maintenance, creating potential risk of unauthorized artifact collection. Personnel, however, would be reminded of the sensitivity of cultural resources and the mitigation measures that might be required if sites are inadvertently damaged or destroyed. Thus, no significant or other adverse impacts to archaeological sites or historic buildings/structures are expected to occur.

#### **4.1.1.5      *Coastal Zone Management***

For the CSM Demonstration, the only facilities and operations that would take place within the CA Coastal Zone are: (1) site modifications and launch operations at TP-01; and (2) payload processing activities at Building 1806, if selected. Although these facilities would be used to support a new launch program, the types of activities proposed to occur would be similar to that of their current and/or prior usage.

As discussed in other sections of Chapter 4.0, the CSM Demonstration activities that are proposed to occur within the coastal zone would not result in significant impacts to sensitive biological or cultural resources, nor would such actions have lasting effects on the scenic beauty along the coast. During the CSM Demonstration launch at TP-01, Point Sal State Beach (located at the northern end of the base) would be closed for public safety purposes. Under agreement with Santa Barbara County and the State of California, the base can close the state beach during launch operations (VAFB, 2008a). Point Sal State Beach is closed on average 12 times a year, which usually coincides with any launch activity (Ornelaz, 2009). There will be no additional restrictions, other than this additional launch, to public access at Point Sal State Beach or for any other public beaches on Vandenberg AFB beyond what is already agreed to in existing county and state agreements. Because only one CSM Demonstration launch would occur, the increase in beach closures would be minimal and would not have a major effect on local recreation.

Under the Proposed Action, the USAF would comply with Federal Coastal Zone Consistency regulations (15 CFR Part 930) and the California Coastal Zone Management Program. Because the proposed CSM Demonstration activities would not have a significant impact on physical and natural resources, require implementation of new restrictions to beach access or other recreational areas, or adversely affect the

visual qualities of the coastline, the SMC prepared a Negative Determination in accordance with the Federal and state regulations. With the assistance of personnel at Vandenberg AFB, SMC submitted the Negative Determination letter to the CCC in October 2009 for their review and concurrence. In a letter dated December 7, 2009, the CCC agreed that the Proposed Action would not adversely affect coastal resources and, therefore, concurs with the Negative Determination (refer to Appendix A, page A-4).

#### **4.1.1.6 Water Resources**

##### **4.1.1.6.1 Site Modifications and Pre-Launch Preparations**

None of the CSM Demonstration facilities and activities, as described in Section 2.1.2.1, would be located within or affect floodplain areas. Because all construction activities would result in less than 1 acre (0.4 hectare) of total soil disturbance, a stormwater permit under the state's National Pollutant Discharge Elimination System (NPDES) General Permit for Construction is not required.

For the proposed firebreaks at TP-01, vegetation removal would be accomplished using cutting and mowing methods; no scraping or other soil disturbance would occur. Although excavation requirements and concrete repairs/modifications would be minimal at TP-01, the construction contractor would apply state-approved BMPs for soil erosion control, and for the collection and disposal of waste concrete and wastewater from concrete truck washout. No concrete wastes or wastewater would be allowed to enter drainages or surface waters.

During installation of the approximately 4,900 ft (1,494 m) of fiber optic cable from TP-01 to Building 1819, trenching activities could result in short-term adverse water quality impacts to nearby wetlands and groundwater. Potential impacts could include increased siltation and turbidity levels from stormwater runoff, as well as contamination from accidental spills of fuel, anti-freeze, and oil used in construction equipment. However, the shallow trench (approximate 12 in [30 cm] deep and 9 in [23 cm] wide) would be located in previously disturbed areas of soil adjacent to existing roadways, and outside of wetland areas or other surface waters. After the completion of each leg of trenching and cable installation, the construction contractor would also implement appropriate soil erosion controls, such as the spreading of soil binders and hydro-seeding with a seed mixture approved by the base Environmental Office.

To minimize potential impacts from spills, the construction contractor would be required to prepare a hazardous material Spill Prevention and Response Plan and obtain concurrence from the base Environmental Office. The plan would include the implementation of BMPs, such as daily inspections of construction vehicles and equipment for fluid leaks, secondary containment provisions for equipment fueling sites, and proper handling and disposal of vehicle wastes. The base *Hazardous Materials Emergency Response Plan* (30 SW Plan 32-4002-A) would also provide resources and guidelines for use in the control, cleanup, and emergency response for spills of hazardous material or waste during facility modifications/construction and pre-launch activities. In the event that a release of hazardous material or waste would occur, affected areas would be treated in accordance with applicable Federal, state, and local regulations. Therefore, the risk of accidental spills would be minimal.

Because the Minotaur IV Lite rocket motors would use only solid propellants (no liquid fuels), there is no potential for accidental releases of propellant during motor handling or other related ground operations.

As a result, no significant impacts to groundwater or surface waters are expected to occur during site modifications/construction and pre-launch preparations.

#### **4.1.1.6.2      *Launch Activities***

During a nominal Minotaur IV Lite vehicle launch, rocket emissions would not impact surface waters or groundwater except for the potential for a short-term, minor decrease in pH from hydrogen chloride emissions, particularly in wetlands near the TP-01 launch pad. In general, IRP studies at Vandenberg AFB have not shown long-term concerns for contamination to groundwater from repeated launches of similar solid-propellant systems (USAF, 2006).

There is a remote possibility that an early flight termination could result in propellant release and other rocket debris over inland water bodies or drainages. However, the probability for direct impact to an individual water body or stream is extremely low. In addition, an accident response team would be available immediately to negate or minimize adverse effects and dispose of the recovered fuel in accordance with 30 SW hazardous waste management procedures.

Therefore, no significant impacts to water resources are expected to occur during launch activities.

#### **4.1.1.6.3      *Post-Launch Operations***

Post-launch activities would not require pad wash down or other wastewater generation. As a result, there would be no significant impacts to water resources.

#### **4.1.1.7      *Health and Safety***

##### **4.1.1.7.1      *Site Modifications and Pre-Launch Preparations***

For the proposed facility modifications at Vandenberg AFB, all program personnel would be required to comply with applicable AFOSH and OSHA regulations and standards.

The launch vehicle integration and launch site preparations for the CSM Demonstration represent routine types of activities at the base. All applicable Federal, state, and local health and safety requirements, such as OSHA regulations within 29 CFR, would be followed, as well as all appropriate DoD and USAF regulations. The handling of large rocket motors, the PDV integrated payload, and other vehicle ordnance is a hazardous operation that requires special care and training of personnel. By adhering to the established and proven safety standards and procedures identified in Section 3.1.7 of this EA, the level of risk to base personnel and the general public would be minimal.

Pre-launch ground tests of the telemetry and tracking systems used on the PDV and Minotaur IV Lite booster would comply with AFOSH Standard 48-9 (*Radio Frequency Radiation Safety Program*) and 30 SWI 13-209 (*Procedures for Operations Involving Non-Ionizing Radiation*) for limiting potential human exposure to non-ionizing (radio frequency) radiation.

As a result, the proposed site modifications and pre-launch preparations would not cause significant impacts on human health and safety.

##### **4.1.1.7.2      *Launch Activities***

Adherence to the policies and procedures identified in Section 3.1.7 protects the health and safety of on-site personnel. During launches, public safety and health are ensured through the establishment of Launch Hazard Areas, impact debris corridors, beach and access road closures (as necessary), and the coordination and monitoring of train traffic passing through the base, in addition to the NOTMARs and NOTAMs published for mariners and pilots. In support of each mission, a safety analysis would be

conducted prior to launch activities to identify and evaluate potential hazards and reduce the associated risks to a level acceptable to Range Safety. For each rocket launch from Vandenberg AFB, the allowable public risk limit for launch-related debris is extremely low, as the following RCC Standard 321-07 criteria show:

- Individuals within the general public must not be exposed to a probability of casualty greater than 1 in 1,000,000 for any single mission. Collective risk for the general public (i.e., the combined risk to all individuals exposed to the hazard) must not exceed a casualty expectation of 1 in 10,000 for any single mission.
- Non-mission ships will be restricted from near-shore hazard areas, where the probability of impact of debris capable of causing a casualty exceeds 1 in 10,000 for non-mission ships.
- Non-mission aircraft in near-shore areas will be restricted from hazard volumes of airspace, where the cumulative probability of impact of debris capable of causing a casualty on an aircraft exceeds 1 in 10,000,000 for all non-mission aircraft. (RCC, 2007)

For comparison purposes, the 2005 average annual probability of fatality in the US from non-transportation accidental (unintentional) injuries was 1 in 4,274 (National Safety Council, 2009). This probability record included falls, fire and burns, drowning, electrical shock, and poisoning. Thus, the risk of fatality to the public from the CSM Demonstration launch at Vandenberg AFB would be substantially less than the risk from non-transportation related accidents. Overall, no significant impacts on health and safety are expected.

#### **4.1.1.7.3      *Post-Launch Operations***

The post-launch cleanup, maintenance, and repair activities to occur at the TP-01 launch pad represent routine types of operations conducted at Vandenberg AFB. All applicable Federal, state, and local health and safety requirements, such as OSHA regulations, would be followed, as well as all appropriate DoD and USAF regulations. By adhering to the established safety standards and procedures identified in Section 3.1.7, the level of risk to military personnel, contractors, and the general public would be minimal. Thus, no significant impacts on health and safety are expected.

#### **4.1.1.8      *Hazardous Materials and Waste Management***

##### **4.1.1.8.1      *Site Modifications and Pre-Launch Preparations***

CSM Demonstration related facility modifications and pre-launch preparations would not damage or interfere with existing IRP treatment and monitoring systems on base. Modifications to the TP-01 launch pad and the use of other base facilities would not affect any areas of asbestos or LBP. Although minimal amounts of non-hazardous construction and demolition debris would be generated, such wastes would be managed in accordance with the disposal and recycling requirements specified in the base *Solid Waste Management Plan* (30 SW 32-7042).

To minimize potential impacts from equipment fluid spills (e.g., fuel, oil, and anti-freeze), the construction contractor would be required to prepare a hazardous material Spill Prevention and Response Plan and obtain concurrence from the base Environmental Office. The plan would include the implementation of BMPs, such as daily inspections of construction vehicles and equipment for fluid leaks, secondary containment provisions for equipment fueling sites, and proper handling and disposal of vehicle wastes. The base Hazardous Materials *Emergency Response Plan* (30 SW Plan 32-4002-A) would also provide resources and guidelines for the control, cleanup, and response to accidental spills of

hazardous material or waste during facility modifications/construction and pre-launch activities. In the event that a release of hazardous material or waste would occur, personnel would immediately treat affected areas.

The launch vehicle integration and launch site preparations represent routine types of activities at the base. During pre-launch preparations, small quantities of lubricants, paints, sealants, and solvents (less than 10 lb [4.5 kg]) would be used. All hazardous materials and associated wastes would be responsibly managed in accordance with the well-established policies and procedures identified in Section 3.1.8. As an example, key elements in the management of hazardous liquids would include material compatibility, security, leak detection and monitoring, spill control, personnel training, and specific spill-prevention mechanisms. Whenever possible, CSM Demonstration related operations at Vandenberg AFB would use environmentally preferred and/or recyclable materials.

All hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable Federal, state, local, DoD, and USAF regulations. Hazardous material and waste-handling capacities would not be exceeded, and management programs would not have to change. Thus, no significant impacts from hazardous materials and waste management would occur.

#### **4.1.1.8.2      *Launch Activities***

The CSM Demonstration launch activities would not normally release hazardous materials or generate hazardous waste. In general, IRP studies at Vandenberg AFB have not shown any long-term concerns for contamination to soils and groundwater from repeated launches of similar solid-propellant systems (USAF, 2006).

If an early launch abort were to occur, base actions would be taken immediately to recover unburned solid propellants and any other hazardous materials that had fallen on the beach, off the beach within 6 ft (1.8 m) of water, or in any of the nearby freshwater creeks. Recovery from deeper water along the shoreline would be treated on a case-by-case basis. Collected waste materials would be properly disposed of in accordance with applicable regulations. Consequently, no significant impacts from the management of hazardous materials and waste are expected.

#### **4.1.1.8.3      *Post-Launch Operations***

The post-launch cleanup, maintenance, and repair activities to occur at the TP-01 launch pad represent routine types of operations conducted at Vandenberg AFB. During this process, all hazardous materials would be responsibly managed in accordance with the well-established policies and procedures identified in Section 3.1.8. Hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable Federal, state, local, DoD, and USAF regulations. Hazardous material and waste-handling capacities on base would not be exceeded and management programs would not have to change. As a result, no significant impacts from the management of hazardous materials and waste would occur.

### **4.1.2      OVER-OCEAN FLIGHT CORRIDOR AND THE GLOBAL ENVIRONMENT**

#### **4.1.2.1      *Global Atmosphere***

##### **4.1.2.1.1      *Stratospheric Ozone Layer***

Exhaust emissions from the rocket motors contain both Cl compounds and free Cl, produced primarily as HCl at the nozzle. A Minotaur IV Lite launch would release approximately 0.14 tons of Cl and 16.3 tons of HCl (see Table 4-3). The Cl and HCl would have a long enough tropospheric lifetime to mix

eventually with the stratosphere, even when released at ground level. The global release of emissions from rocket launches, however, is small enough that it is not listed as a significant source of ozone depleting gases by the WMO (2006). It is also estimated that the emission loads of Cl (as HCl and Cl) from rocket launches worldwide, as projected from 2004 to 2014, would account for only 0.5 percent of the industrial Cl load from the US over the 10-year period (MDA, 2007a).

Both  $\text{Al}_2\text{O}_3$  and  $\text{NO}_x$  are also of concern with respect to stratospheric ozone depletion. The launch would release approximately 30 tons of  $\text{Al}_2\text{O}_3$ . The  $\text{Al}_2\text{O}_3$  is emitted as solid particles and can activate Cl in the atmosphere. The exact magnitude of ozone depletion that can result from a buildup of  $\text{Al}_2\text{O}_3$  over time has not yet been determined quantitatively, but is considered insignificant based on existing analyses (USAF, 2001). Following the launch, the majority of this compound would be removed from the stratosphere through dry deposition and precipitation.  $\text{NO}_x$ , like certain Cl compounds, also contributes to catalytic gas phase ozone depletion. The production of  $\text{NO}_x$  species from solid rocket motors is dominated by high-temperature “afterburning” reactions in the exhaust plume. As the temperature of the exhaust decreases with increasing altitude, less  $\text{NO}_x$  is formed. Because diffusion and winds would disperse the  $\text{NO}_x$  species generated, no significant effect on ozone levels is expected.

In summary, rocket emissions from the CSM Demonstration flight test would not have a significant impact on stratospheric ozone depletion; however, any emission of ozone-depleting gases represents a minute increase that could have incremental effects on the global atmosphere.

#### **4.1.2.1.2 Greenhouse Gases and Global Warming**

Under the Proposed Action, all combined CSM Demonstration activities at Vandenberg AFB and from the launch would release approximately 230 tons (209 metric tons) of  $\text{CO}_2$ . Detailed emission calculations of GHGs from facility modifications and pre-launch preparations, launch, and post-launch activities at Vandenberg AFB are provided in Appendix C.

A small number of support ocean vessels, aircraft, and other equipment would be used at USAKA/RTS and around the Marshall Islands to support CSM Demonstration terminal phase preparations and operations. Although the full extent of their use has not yet been determined, it is expected to be limited and temporary. In addition, the availability of GHG emission factors for vessels and some aircraft is limited. For these reasons, GHG emissions from such sources were not quantified in this analysis. The amount of emissions that would be released, however, is assumed to be negligible.

$\text{CO}_2$  is the only GHG identified in the Kyoto Protocol or the California Climate Action Registry that would be emitted during launch of the Minotaur IV Lite booster. Because of the solid propellant used, the launch would release only 2 tons (1.8 metric tons) of  $\text{CO}_2$ . For comparison, the  $\text{CO}_2$  emissions from all USAF launch vehicles (e.g., Atlas, Delta, Titan, and Minuteman) in CY 2005 represents the emissions of 130 passenger cars operated that year (DeSain and Brady, 2007).

The amount of  $\text{CO}_2$  released by all CSM Demonstration activities is expected to be less than 0.0001 percent of the anthropogenic emissions for this gas released on a global scale annually (USEPA, 2007). In addition, the CEQ recently released draft guidance on when and how Federal agencies should consider GHG emissions and climate change in NEPA analyses. The draft guidance includes a presumptive effects threshold of 27,563 tons (25,000 metric tons) of  $\text{CO}_2$  equivalent emissions from a proposed action on an annual basis (CEQ, 2010). The GHG emissions associated with the Proposed Action fall well below the CEQ threshold. Although this limited amount of emissions would not contribute significantly to global warming, any emission of GHG represents a minute increase that could have incremental effects on the global atmosphere.

#### 4.1.2.2 Biological Resources

The proposed CSM Demonstration flight test would not have a discernible or measurable impact on benthic or planktonic organisms because of their abundance, their wide distribution, and the protective influence of the mass of the ocean around them. The potential exists, however, for impacts to larger vertebrates in the nekton, particularly those that must come to the surface to breathe (e.g., marine mammals and sea turtles). Potential impacts to such species could occur from sonic booms produced by the flight test vehicle, the splash-down effects of launch vehicle stages, and the release of propellants or other contaminants into the water.

Because of the potential for ESA-listed and other protected marine species to be affected, the USAF initiated consultations with the NMFS (Pacific Islands Regional Office) in June 2009. In their response letter provided in Appendix E, the NMFS concurred with the USAF's determination that conducting a single CSM Demonstration flight test from Vandenberg AFB to USAKA/RTS is not likely to adversely affect marine species or critical habitats protected under the ESA and RMI statutes. For each impact issue, the NMFS concluded that the effects would be insignificant or discountable.

Detailed discussions on individual impact issues are provided in the following sections.

##### 4.1.2.2.1 *Sonic Boom Overpressures*

#### Open-Ocean Environments

As described in Section 4.1.1.2.2, launch of the Minotaur IV Lite booster from Vandenberg AFB would generate a sonic boom off the CA Coast in open-ocean areas. The propagation of sonic booms underwater could affect the behavior and hearing sensitivity in marine mammals (primarily cetaceans), sea turtles, and other fauna. Depending on the level of exposure, this threshold shift in hearing may be temporary (TTS) or permanent (PTS). TTS can temporarily impair an animal's ability to communicate, navigate, forage, and detect predators. As a sound gets louder, the duration required to induce TTS gets shorter. Exposure to sound in excess of that required to cause TTS may result in a PTS (National Research Council, 2005).

Although sonic boom data for the Minotaur IV Lite booster is unavailable, prior studies of similar ICBM flight test vehicles launched from Vandenberg AFB have shown that maximum sonic boom overpressures would occur at distances of about 25 nmi (46 km) off the coast and last no more than 250 milliseconds or a quarter second (USAF, 2004). The surface footprint of the sonic boom can extend outward many miles on each side of the flight path, but it quickly dissipates with increasing distance. Using Atlas V sonic boom data (USAF, 2000) as a conservative estimate for the Minotaur IV Lite, the upper range of sonic boom overpressures generated by the CSM Demonstration launch would be 7.2 psf at the water's surface. This overpressure is equivalent to 145 dB (re 20  $\mu$ Pa) in air and 171 dB (re 1  $\mu$ Pa) in water at the air-to-water interface. The overpressure (sound levels) would dissipate with increasing distance and ocean depth.

Following PDV separation from the booster, the test vehicle would also produce sonic booms during its hypersonic glide towards USAKA/RTS. Along its flight path, the vehicle would generate a moving sonic boom or carpet boom very similar to that of the HTV-2 test vehicle previously analyzed in the HTV-2 EA (USAF, 2009b). The width of the boom "carpet" beneath the vehicle would be a little over 100 nmi (185 km). The carpet boom overpressures, however, would not be uniform. The maximum peak overpressure at ocean level would be around 0.21 psf directly beneath the vehicle, but then decrease laterally away from the flight path until the boom effects cease altogether. This overpressure would be equivalent to 114 dB (re 20  $\mu$ Pa) in air and 140 dB (re 1  $\mu$ Pa) in water at the air-to-water interface. Within the areas of the

NWHI, the overpressures likely would not exceed 111 dB (re 20  $\mu$ Pa) in air and 137 dB (re to 1  $\mu$ Pa) underwater. Just as mentioned before, the overpressure (sound levels) would dissipate with increasing distance and ocean depth.

Based on prior consultations for the HTV-2 program, the NMFS determined that the Minotaur IV Lite sonic boom impulsive sounds and resulting underwater overpressures (up to approximately 171 dB [re 1  $\mu$ Pa]) would exceed TTS thresholds for cetaceans (USAF, 2009b).<sup>11</sup> However, the PDV carpet boom underwater effects (up to approximately 140 dB [re 1  $\mu$ Pa]) would not exceed such thresholds. These effects would generate minimal in-water sonic boom footprints where adverse levels of sound may be encountered and the potential exposure would last for only a quarter second during the flight test at any given location along the flight path. Based on the limited area and duration of potential exposure to adverse sound levels, and the belief that ESA-listed marine species densities along the projected flight path are low and patchy in distribution, the NMFS considered these levels of potential acoustical effects to be discountable.

Sea turtle auditory sensitivity is not well studied; however, research suggests that the animals are less sensitive to the auditory effects of impulsive sounds than marine mammals (Ridgeway et al., 1969; USN, 2008a, 2008b). The cetacean thresholds for TTS and PTS are likely to be particularly conservative for sea turtles (USAF, 2009b). Thus, the Minotaur IV Lite sonic boom and PDV carpet boom underwater acoustical effects on sea turtles can also be considered negligible.

Thus, the sonic booms generated along the over-ocean flight corridor are not expected to have a significant impact on marine mammals or sea turtles.

### **Atoll and Island Environments**

Similar to the HTV-2 (Mission A) flight test previously analyzed in the HTV-2 EA (USAF, 2009b), the PDV would pass directly over the NWHI and the Papahānaumokuākea Marine National Monument in the area of Maro Reef, Gardner Pinnacles, Brooks Banks, and French Frigate Shoals. The resulting sonic boom carpet in this area would not be expected to exceed 0.15 psf (111 dB [re 20  $\mu$ Pa] in air). In comparison, this noise level would be less than the 0.42 psf (120 dB [re 20  $\mu$ Pa] in air) overpressure produced by a thunderclap at close range (Vavrek et al., 2008). Because the carpet boom overpressures would occur only once at any location and last no more than a few hundred milliseconds, no significant impacts are expected to either terrestrial or marine species in this area.

#### **4.1.2.2.2 Direct Contact and Shock/Sound Wave from the Splashdown of Vehicle Components**

As shown in Figure 2-4, the three Minotaur IV Lite spent rocket motors would impact in deep ocean waters, well away from coastal areas. The payload fairing would also impact in the same general area as the stage-2 motor. During their descents, each motor would hit the ocean surface at speeds of approximately 195 to 230 ft per second (59 to 79 m per second) (USAF, 2006). The expended motors—each weighing up to 9,431 lb (4,278 kg)—would have considerable kinetic force. Upon impact, this transfer of energy to the ocean water would cause a shock wave (low-frequency acoustic pulse) similar to that produced by explosives.

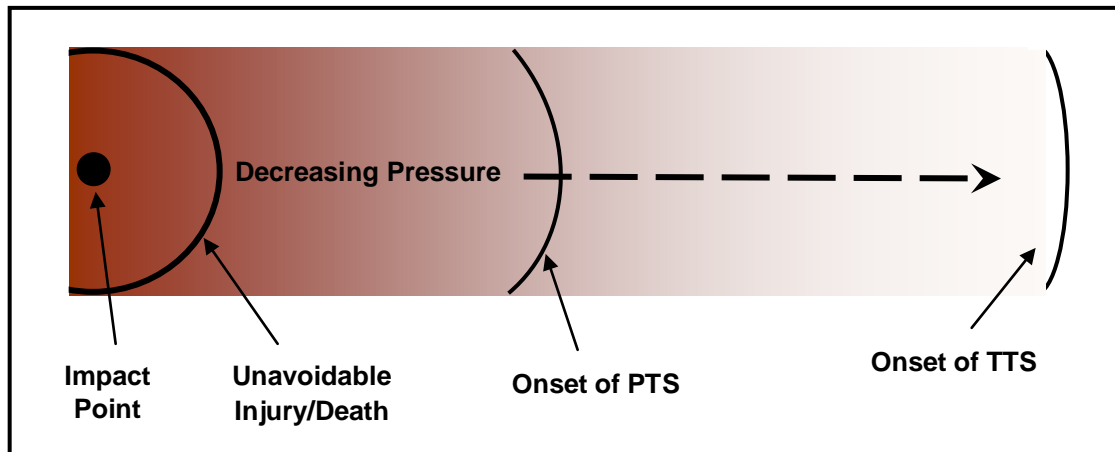
If a portion of the launch vehicle were to strike a protected marine mammal or sea turtle near the water surface, the animal would most likely be killed. In addition, the resulting underwater shock/sound wave radiating out from the impact point could potentially harm other animals. Close to the impact point, the

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<sup>11</sup> For the TTS threshold in cetaceans, the NMFS used the criterion of 160 dB<sub>root-mean-square (rms)</sub> (re 1  $\mu$ Pa) for exposure to impulse sounds (USAF, 2009b). The RMS of a sonic pulse represents that portion of a pulse that contains 80 percent of the sound energy.



shock/sound wave might cause PTS, injure internal organs and tissues, or prove fatal to the animals. Slightly further away, TTS effects might occur, but with increasing distance away from the impact point, pressure levels would decrease, as would the risk for injury. Figure 4-2 illustrates the relative distances for these shock/sound wave effects on animals.



**Figure 4-2. Illustration of the Relative Underwater Radial Distances for Shock/Sound Wave Effects on Marine Mammals and Sea Turtles**

Research shows that an underwater sound level of approximately 240 dB (re 1  $\mu$ Pa) is the baseline criterion for defining unavoidable injury or death in marine mammals (Ketten, 1998). Such effects would occur within several feet or yards of each rocket motor impact point. For TTS and PTS effects on marine mammals and sea turtles, this EA used a dual-exposure criteria approach based on recent studies conducted by the US Department of the Navy (USN) for underwater detonations and ship-shock trials (USN, 2008a, 2008b). The criteria use both peak pressure levels in dB (re 1  $\mu$ Pa) and energy flux density values, which are a measure of the sound energy flow per unit area expressed in dB (re 1  $\mu$ Pa<sup>2</sup>-s) for underwater sound. Table 4-4 presents the estimated radial distances for the onset of TTS and PTS for each booster component based on the USN criteria. Energy flux density criteria result in much larger radial distances, when compared to peak pressure criteria. The distances shown in the table are the same as those previously identified in the HTV-2 EA (USAF, 2009b).

Within the ROI, population estimates and migratory routes for most marine mammal species are not available; thus, calculating probabilities for impacts based on animal densities is currently not possible. Assuming a low density of species in the ROI, the potential for marine mammals to be impacted is extremely low because: (1) there are only four Minotaur IV Lite component impact points along 1,400 nmi (2,593 km) of open ocean, and (2) each impact point would affect a relatively small area. Through recent consultations, the NMFS determined that the Minotaur IV Lite component impacts in the North Pacific would be discountable for protected marine mammal and sea turtle species.

As a result, the splashdown of Minotaur IV Lite components in the over-ocean flight corridor is not expected to have a significant impact on marine mammals or sea turtles.

#### **4.1.2.2.3 Contamination of Seawater**

By the time the spent rocket motors impact in the ocean, all of the solid propellants in them would be consumed. The residual aluminum oxide and burnt hydrocarbon coating the inside of the motor casings

**Table 4-4. Estimated Underwater Radial Distances for the Onset of TTS and PTS in Marine Mammals and Sea Turtles from Minotaur IV Lite Component Impacts in the Ocean**

Potential Effect	Criterion	Criterion Source	Radial Distance from Impact Point ft (m)			
			Stage 1	Stage 2	Stage 3	Fairing
PTS	230 dB (re 1 $\mu$ Pa) peak pressure	USN, 2008b	4 (1.2)	4 (1.2)	2 (0.6)	1 (0.3)
	205 dB (re 1 $\mu$ Pa <sup>2</sup> -s) energy flux density	USN, 2008a	28 (8.5)	23 (7.0)	12 (3.7)	5 (1.5)
TTS	224 dB (re 1 $\mu$ Pa) <sup>1</sup> peak pressure	USN, 2008a, 2008b	9 (2.7)	7 (2.1)	4 (1.2)	2 (0.6)
	182 dB (re 1 $\mu$ Pa <sup>2</sup> -s) energy flux density	USN, 2008a	392 (119.5)	323 (98.5)	171 (52.1)	70 (21.3)

**Notes:**

<sup>1</sup> A peak pressure of 224 dB (re 1  $\mu$ Pa) is equivalent to 23 psi.

would not present any toxicity concerns. Although the nickel-cadmium batteries carried onboard the launch vehicle would be spent (discharged) by the time they impact in the ocean, small quantities of electrolyte material would remain in the batteries. The battery materials, along with several gallons of hydraulic fluid from each motor's TVC system, could mix with the seawater causing localized contamination. The release of such contaminants could potentially harm marine life that comes in contact with, or ingests, toxic levels of these solutions.

Previous studies of missile tests concluded that the release of hazardous materials carried onboard rocket systems would not be significant (USN, 2008a). Materials would be rapidly diluted in the seawater and, except for the immediate vicinity of the debris, would not be found at concentrations identified as producing adverse effects. Ocean depths in the ROI reach thousands of feet and, consequently, any impacts from hazardous materials are expected to be insignificant. The area affected by the dissolution of hazardous materials onboard would be relatively small because of the size of the rocket components and the minimal amount of residual materials they contain. Such components would immediately sink to the ocean bottom, out of reach of marine mammals, sea turtles, and most other marine life. It is possible for deep-ocean, benthic species to be adversely affected by any remaining contaminants, but such impacts would be localized to within a short distance of rocket debris deposited on the ocean floor.

#### **4.1.2.2.4 Failed or Terminated Launch**

In the unlikely event of a system failure during launch or an early termination of flight, the launch vehicle would fall to the ocean intact or as debris scattered over a large area. It is expected that the falling debris would not have a significant impact on biological resources because of the large ocean area and the very low probability of striking a marine mammal or sea turtle.

Initiating flight termination after launch would split or vent the solid propellant motor casing, releasing pressure. Large quantities of unburned propellant, which is composed of ammonium perchlorate, aluminum, and other materials, could be dispersed over an ocean area of up to several square miles. Of particular concern is the ammonium perchlorate, which can slowly leach out of the solid propellant resin binding-agent once the propellant enters the water. However, as described in Section 4.1.1.3.2, it is

unlikely that perchlorate concentrations would accumulate to a level of concern. The overall concentration and toxicity of dissolved solid propellant from the unexpended rocket motors, or portions of them, is expected to be negligible and without any substantial effect. Any propellant fragments expelled from a destroyed or exploded rocket motor would sink hundreds or thousands of feet to the ocean floor. At such depths, the material would be beyond the reach of most marine life.

#### **4.1.3 US ARMY KWAJALEIN ATOLL/REAGAN TEST SITE AND THE MARSHALL ISLANDS**

For USAKA/RTS, the analysis discussions presented under each resource topic are broken out into three key phases of operations: (1) pre-test preparations and support; (2) terminal flight and impact activities; and (3) post-test operations. The discussions focus on those activities, facilities, and test areas that could result in potential environmental impact. This includes analysis of the two alternative PDV impact sites described in Section 2.1.2.3 and listed below:

- **Preferred Alternative:** Land impact at Illeginni Islet
- **BOA Alternative:** Ocean impact north of USAKA/RTS in international waters

##### **4.1.3.1 Air Quality**

###### **4.1.3.1.1 Pre-Test Preparations and Support**

Pre-test preparations and support would include the use of mobile and non-road sources of air emissions. Depending on the alternative selected (i.e., Preferred Alternative or BOA Alternative), the emission sources could include a combination of vessels, aircraft, a crane, truck, fork lift, cement mixer, backhoe/loader, and/or portable power generators. Emission of criteria pollutants and GHG from these sources would be minor and temporary. There would be no exceedance of UES air quality standards, no new permanent stationary sources of emissions, and no changes to air emission permits. As a result, pre-test preparation and support requirements for either alternative would not cause significant impacts on local or regional air quality.

###### **4.1.3.1.2 Terminal Flight and Impact Activities**

###### **Preferred (Land Impact) Alternative**

Just prior to impact on Illeginni Islet, the PDV would disperse thousands of particles over the intended impact area at very high velocities. During impact, the PDV and the payload particles could partially disintegrate into fugitive dust around the impact site and a short distance downwind. Additional fugitive dust would be generated from crater formation by the remaining portion of the PDV. Although the PDV would contain heavy metals—including approximately 0.35 ounces (10 g) of Be, 4.0 lb (1.8 kg) of Cr, and 10.3 lb (4.7 kg) of Ni—that could generate small quantities of HAPs, trade winds would rapidly dissipate any airborne dust. Also, as previously described in Chapter 3, air and soil sampling at Illeginni Islet have not shown elevated levels of Be or DU as a result of prior ICBM reentry vehicle flight tests at the same location. Thus, any test-related disturbance of the soil within the impact area would not generate additional HAPs.

Because of trade winds, the implementation of standard range evacuation procedures, and the lack of populated areas within miles of Illeginni Islet, there would be no HAP inhalation risks to personnel or residents on Kwajalein Atoll. Thus, no significant impacts to air quality would occur.

## **BOA Alternative**

Like the Preferred Alternative, the PDV would disperse thousands of particles just prior to impacting the barges in international waters. During impact, the PDV and the particles could partially disintegrate into fugitive dust over the barges and some distance downwind. As a result, it is possible for small quantities of HAPs to be generated. Because of trade winds that would dissipate any airborne dust and the lack of receptors in the BOA, there would be no significant impacts to air quality.

### **4.1.3.1.3 Post-Test Operations**

## **Preferred (Land Impact) Alternative**

The PDV impact would be a short-term discrete event. Because of strong trade winds on the islets, the dispersion of the fugitive dust is expected to be rapid and effective. As part of initial cleanup activities, personnel would stabilize fugitive dust and disturbed soil by wetting/washing the site with freshwater.

Direct measurements of previous ICBM reentry vehicle tests have provided sufficient information to conclude that there would be no potential HAPs-related health effects in the vicinity. Long-term air sampling following such tests has shown that Be and U concentrations in air downwind of impact areas are essentially indistinguishable from natural concentrations of Be and U in air at other atoll locations (Robison, 2006). Similar findings would be expected for any heavy metal deposition (e.g., Cr and Ni) resulting from the PDV impact. Additionally, the PDV would impact the islet at a much lower velocity than the ICBM test vehicles. Thus, it is expected that any disintegration of metal components from the PDV would be much less.

As a result, established US and UES air quality standards for Be, U, and other heavy metals would not be exceeded. Just as during pre-test preparations, emission from vessels, aircraft, and heavy equipment also would not exceed UES air quality standards. Because only one CSM Demonstration flight test would be conducted, overall impacts to air quality at USAKA/RTS would be insignificant.

## **BOA Alternative**

Following the PDV impact, trade winds would rapidly disperse any fugitive dust. On returning to the barges to assess the impact, personnel accessing the barges would wet or wash down the barge decks to eliminate any dust concerns prior to towing the barges back to USAKA/RTS. Just as during pre-test preparations, emission from vessels and support equipment also would not exceed UES air quality standards. As a result, there would be no significant impacts to air quality.

### **4.1.3.2 Noise**

#### **4.1.3.2.1 Pre-Test Preparations and Support**

Pre-test preparation activities for either alternative (Preferred Alternative or BOA Alternative), including vessel and aircraft operations, are not expected to have any noise impacts on local RMI communities. Under the Preferred Alternative, most of the noise would occur on Illeginni. The use of trucks, power tools, compressors, and other machinery would produce noise levels ranging from 85 to 104 dBA for brief periods at close range (Suter, 2002). Personnel would be required to comply with the Army's Hearing Conservation Program requirements (as described in Section 3.3.2) and other applicable occupational health and safety regulations. As a result, the proposed pre-test preparation activities would not cause significant noise impacts.

#### 4.1.3.2.2 *Terminal Flight and Impact Activities*

Terminal flight of the PDV over the Marshall Islands would create a sonic boom carpet along its flight path, similar to that described in Section 4.1.2.2.1 for the over-ocean flight corridor. Because of the vehicle's high altitude (approximately 100,000 ft [30,480 m]), resulting sonic boom overpressures at sea level would be relatively low, ranging from about 0.12 to 0.21 psf (109 to 114 dB [re 20  $\mu$ Pa] in air). As the PDV nears the intended impact site, a more focused sonic boom would occur.

#### **Preferred (Land Impact) Alternative**

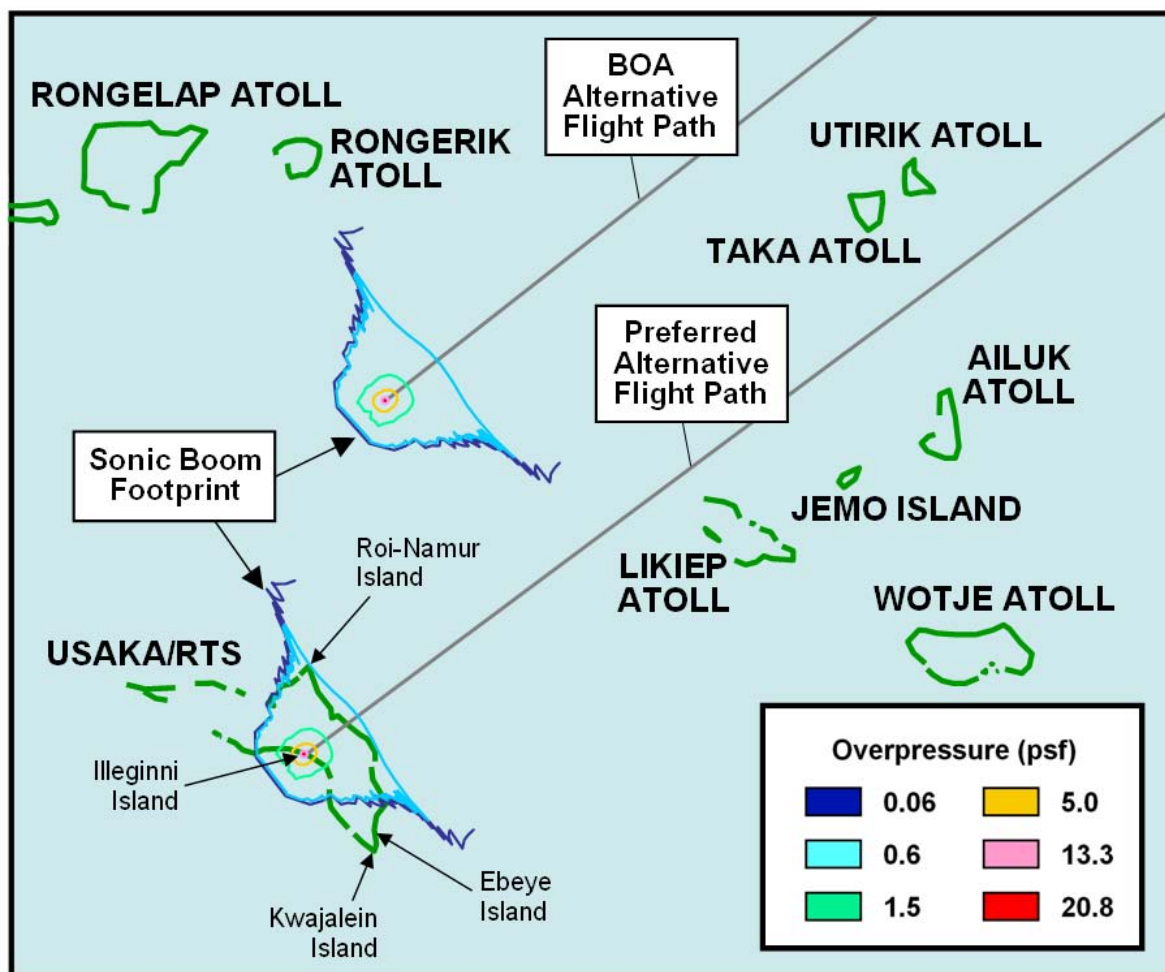
Depending on the final trajectory of the PDV, it is possible for communities located on Utirik, Ailuk, and Likiep Atolls to be affected by the carpet boom as the vehicle passes by (see Figure 2-5). Because none of the atolls would be directly under the PDV flight path, the sonic boom at these locations would be less than 0.21 psf (114 dB [re 20  $\mu$ Pa] in air). Such noise levels would be well below the 120 dB produced by a thunderclap (Vavrek et al., 2008) and well within the Army standard of 140 dB (peak sound pressure level) for impulse noise. The carpet boom would be audible once at each location, last no more than a fraction of a second, and would introduce a low risk of concern and complaint amongst residence.

As the PDV nears USAKA/RTS, the vehicle would maneuver towards the pre-designated impact site at Illeginni Islet. During vehicle descent, a focused boom would occur over the islet and the atoll (see Figure 4-3). Sonic boom overpressures at ocean level would range from about 0.06 psf (103 dB [re 20  $\mu$ Pa] in air) along the outer edges of the footprint to approximately 26 psf (156 dB [re 20  $\mu$ Pa] in air) near the point of impact at Illeginni Islet. Such overpressures would be similar to those previously modeled for the HTV-2 program (USAF, 2009b).

Within Kwajalein Atoll, Kwajalein and Roi-Namur islets are the only populated islets under USAKA/RTS management (see Figure 4-3). There are also Marshallese residents located on Ennubirr Islet (just southeast of Roi-Namur Islet), Ebeye Islet, Carlos Islet (located a few miles northwest of Kwajalein Islet), and on a few other islets. As shown on Figure 4-3, Roi-Namur and Ennubirr are the only populated islets that would be located within the focused boom footprint. Depending on meteorological conditions, peak sound pressure levels in these areas could reach 123 dB based on a sonic boom overpressure of 0.6 psf. Although considered reasonably loud, such noise levels would be audible only once at each location, last no more than a fraction of a second, and are well within the Army standard of 140 dB (peak sound pressure level) for impulse noise. Because Carlos, Ebeye, Kwajalein, and the other populated islets are located outside the sonic boom footprint, residents at these locations may not hear the noise at all.

In addition to the focused sonic boom footprint shown in Figure 4-3, the detonation of the integrated payload just prior to PDV impact would generate very loud noise levels. A peak sound pressure level of 180 dB and peak overpressures of 403 psf from the detonation are anticipated at ground level at the impact site on Illeginni Islet. Such sound levels would potentially be lethal to individuals at the point of impact. Sound at these levels could also break windows or crack plaster in structures near the site. Because there are no residents within 18 mi (29 km) of Illeginni Islet, and because of range evacuation procedures during such flight tests, no residents or personnel would be affected. Table 4-5 provides a comparison of the various noise levels generated during PDV terminal flight, including their potential effects.

Overall, neither RMI residents nor USAKA/RTS personnel would be subjected to significant noise-related impacts.



Source: Modified from SMC, 2008

**Figure 4-3. Representative Sonic Boom Footprints from PDV Impacts at Illeginni Island and in the Broad Ocean Area**

### BOA Alternative

Depending on the final trajectory of the PDV, it is possible for communities located on Utirik Atoll to be affected by the carpet boom as the vehicle passes by (see Figure 2-5). Because Utirik Atoll would not be directly under the PDV flight path, the sonic boom at this location would be similar to that of the Preferred Alternative—less than 0.21 psf (114 dB [re 20  $\mu$ Pa] in air). Such noise levels would be well below the 120 dB produced by a thunderclap (Vavrek et al., 2008) and well within the Army standard of 140 dB (peak sound pressure level) for impulse noise. The carpet boom would be audible once, last no more than a fraction of a second, and would introduce a low risk of concern and complaint amongst residence.

As the PDV nears the BOA north of USAKA/RTS, the vehicle would maneuver towards the pre-designated barge impact area. During vehicle descent, a focused boom would occur over a wide area of the ocean (see Figure 4-3), similar to that of the HTV-2 flight tests previously analyzed in the HTV-2 EA (USAF, 2009b). Also, just prior to the PDV impact, the integrated payload would detonate. Noise from the focused boom and detonation would be at the same levels as described for the Preferred Alternative at

**Table 4-5. Maximum Sound Pressures and Possible Effects during PDV Terminal Flight**

<b>Location &amp; Noise Source</b>	<b>Peak Overpressure (psf)</b>	<b>Peak Sound Pressure Level (dB)</b>	<b>General Description</b>	<b>Effects on Humans</b>	<b>Effects on Structures</b>
Under Flight Path (Peak Carpet Boom)	0.21	114	Audible and distant	Low risk of concern from noise	Possible structural rattling, but no physical damage
Several Miles from Impact Site (Focused Boom)	0.6	123	Reasonably Loud	Low risk of concern from noise	Some structural rattling, but no physical damage
At Impact Site (Focused Boom)	26	156	Very loud	Risk of hearing loss	Possible window breakage and plaster cracking.
At Impact Site (Integrated Payload Detonation)	403	180	Very loud	Potentially Lethal	Possible window breakage and plaster cracking.

Sources: 29 CFR 1910.95; AFOSH Standard 48-20; Army Regulation 200-1; Siskind, 1989; SMC, 2008; USAF 1990, 2009.

USAKA/RTS, but would occur entirely within international waters. During the flight test, USAKA/RTS would verify that no non-mission vessels would be in the BOA test area. In addition, all mission support personnel and vessels would evacuate to a safe distance from the barge impact area. Depending on vessel location, on-board personnel may be required to wear hearing protection in compliance with the Army's Hearing Conservation Program (as described in Section 3.3.2). As a result, noise levels are not expected to have a significant impact on the human environment.

#### **4.1.3.2.3 Post-Test Operations**

Noise levels generated during post-test operations for either alternative (Preferred Alternative or BOA Alternative) would be similar to those generated during pre-test preparations. Thus, no significant impacts to ambient noise levels are expected.

#### **4.1.3.3 Biological Resources**

As previously mentioned, the USAF initiated consultations with the NMFS (Pacific Islands Regional Office) in June 2009 because of the potential for ESA-listed and other protected marine species to be affected. In their response letter provided in Appendix E, the NMFS concurred with the USAF's determination that conducting a single CSM Demonstration flight test from Vandenberg AFB to USAKA/RTS is not likely to adversely affect marine species or critical habitats protected under the ESA and RMI statutes. For each impact issue, the NMFS concluded that the effects would be insignificant or discountable.

Also in 2009, the USAF (with USASMDC/ARSTRAT support) entered into consultations with the USFWS (Pacific Islands Fish and Wildlife Office), as required by the ESA and UES, because of potential debris impacts at Illeginni Islet on ESA-listed sea turtles and sea turtle nesting habitat. In response, the USFWS provided the USAF a BO on the effects of the Proposed Action on green and hawksbill sea turtles at Illeginni Islet, the findings of which are discussed below. A complete copy of the USFWS BO is provided in Appendix F.

Further discussions on the results of the consultations are included, where appropriate, in the following sections.

#### **4.1.3.3.1 Pre-Test Preparations and Support**

##### **Preferred (Land Impact) Alternative**

Prior to the shipment of the test support equipment and materials from the US to USAKA/RTS, the equipment would be washed and a certified Pest Control Technician or Military Veterinarian would inspect the equipment and materials to ensure that they do not contain any insects, animals, plants, or seeds. The washing and inspection process would help to prevent exotic species from being introduced into the RMI. In accordance with the USFWS BO (Appendix F), the USAF in conjunction with USAKA would also inspect all project-related cargo and vehicles transiting between islets within the atoll in order to prevent the further spread of rodents. Such inspections would be implemented for the duration of the CSM Demonstration flight test at USAKA/RTS.

On Illeginni Islet, test support equipment and materials would be setup on the western end of the islet in both paved and unpaved open areas—an area of about 2 acres (0.8 hectares) in size. Setup operations would take up to 30 days to complete and could remain in place for up to 60 days. No forested areas or other sensitive habitats on the islet would be disturbed during these activities.

During travel to and from Illeginni Islet, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators would also adjust their speed based on expected animal densities, and on lighting and turbidity conditions. This would include operations for the placement of approximately three sensor rafts near Illeginni Islet. To avoid impacts on coral heads, rafts would not be located in lagoon waters less than 10 ft (3 m) deep. The rafts would either be anchored or would use onboard battery-powered electric motors to maintain position in the water.

The extent of motorized equipment and personnel on Illeginni Islet for several weeks could cause individual birds to leave the western end of the islet. Depending on the nesting season for certain species, tern or other bird nests with eggs on the ground in the open areas could be damaged or covered over. To minimize potential impacts to migratory birds, “scare” techniques would be implemented to discourage birds from nesting in the intended impact area. Such techniques might include use of noisemakers (e.g., propane cannons, sirens, and recorded distress calls) and visual deterrents (e.g., scarecrows, Mylar flags, helium-filled balloons, and strobe lights). The USAKA Environmental Management Office would initiate such actions several weeks prior to the beginning of setup activities on islet. To prevent birds from nesting on the support equipment after initial setup, the equipment would be appropriately covered with tarps or other materials. If possible, the flight test at Illeginni would be conducted during mid-day when birds are typically at rest and less likely to be within the impact area.

As specified in the USFWS BO (Appendix F) to help prevent potential impacts on sea turtle nests, the USAKA Environmental Management Office would begin periodic inspections of the Illeginni Islet beaches for active turtle nests 30 days prior to the flight test. If nests with eggs are discovered, USAKA would immediately notify the Pacific Islands Fish and Wildlife Office and implement USFWS recommendations to avoid or minimize project-related impacts to sea turtle nests. Additionally, within a few days or weeks of the test, USFWS and NMFS biologists would survey Illeginni Islet to document current conditions of sea turtle nesting areas, the conditions of other habitats, and the types and general numbers of individual species.



Because of actions taken to protect sea turtle nests and discourage birds from nesting in the intended impact area, and because support equipment setup operations would be limited to the western end of the islet, pre-test preparations are not expected to have a significant impact on protected wildlife at Illeginni Islet.

As a precaution to minimize potential impacts on marine mammals and sea turtles, USAKA/RTS personnel would conduct a helicopter or fixed-wing aircraft overflight of the Illeginni Islet vicinity at least three times over the week prior to the flight test. The final overflight would be made as close to the proposed test launch time as safely practicable. If personnel observe marine mammals or sea turtles in the vicinity, they would report such findings to the USAKA Environmental Management Office, the RTS Range Directorate, and the Flight Test Operations Director at Vandenberg AFB.

### **BOA Alternative**

In the BOA where the proposed PDV impacts would occur, it is expected that sea turtles, whales, and other marine species occasionally pass through this deep ocean area during migrations or when moving to different feeding areas. In addition to the ocean tug and barges, one or two vessels would temporarily deploy up to approximately 16 free-floating rafts (with optical and/or acoustical sensors and telemetry equipment onboard) in this area prior to the flight test. These and other vessels may remain positioned near the BOA impact area just prior to testing. To account for potential delays, the barges and support vessels would remain in the BOA impact area for up to 10 days before returning to USAKA/RTS. To help prevent migratory birds from being attracted to the barges, “scare” techniques similar to those described earlier would be used on the barges.

During travel to and from impact and test support areas, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators would also adjust their speed based on expected animal densities, and on lighting and turbidity conditions. The noise produced by the vessels might cause marine mammals and sea turtles to temporarily leave the area; however, these effects would be short-term and minimal. Vessel operations would not involve any intentional ocean discharges of fuel, toxic wastes, or plastics and other solid wastes that could potentially harm marine life. Thus, pre-test preparations would not have significant impacts on marine mammals or sea turtles.

If ship personnel observe marine mammals or sea turtles during deployment of the free-floating sensors in the BOA impact area, then they would report such sightings to the USAKA Environmental Management Office, the RTS Range Directorate, and the Flight Test Operations Director at Vandenberg AFB. USAKA/RTS aircraft pilots operating in the vicinity of the impact and test support areas near Roi-Namur Islet would also report any opportunistic sightings of marine mammals and sea turtles.

#### **4.1.3.3.2 Terminal Flight and Impact Activities**

### **Preferred (Land Impact) Alternative**

Carpet Boom Overpressures. As described in Section 4.1.3.2.2, the PDV would create a sonic boom carpet along its flight path over the Marshall Islands, prior to maneuvering towards the designated impact area. The carpet boom overpressures would be relatively low, ranging from about 0.12 to 0.21 psf (109 to 114 dB [re 20  $\mu$ Pa] in air). The carpet boom would likely be audible on Bikar, Taka, and Utirik Atolls. In comparison, the noise levels would be less than the 0.42 psf (120 dB [re 20  $\mu$ Pa] in air) overpressure produced by a thunderclap at close range (Vavrek et al., 2008). Because the carpet boom overpressures would occur only once at each location and last no more than a few hundred milliseconds, there would be negligible effects on terrestrial species in these areas.

The PDV carpet boom peak overpressure would be equivalent to 140 dB (re 1  $\mu$ Pa) in water at the air-to-water interface. Just as described in Section 4.1.2.2.1 for the PDV over-ocean flight corridor, the carpet boom effects within the BOA north of USAKA/RTS and in other ocean areas of the Marshall Islands would have a negligible effect on marine mammals and sea turtles because: (1) the overpressures would generate minimal in-water footprints and be very short in duration, and (2) underwater sound levels would not exceed NMFS thresholds for TTS or PTS.

**Focus Boom Overpressures.** As stated in Section 4.1.3.1.2, the PDV would also create a focused boom as it maneuvers and descends towards the pre-designated impact site at Illeginni Islet. Predicted overpressures at the ocean surface would range from about 0.06 psf (103 dB [re 20  $\mu$ Pa] in air) along the outer edges of the sonic boom footprint to approximately 26 psf (156 dB [re 20  $\mu$ Pa] in air) at the point of land impact (see Figure 4-3). Other islets near Illeginni would experience peak sound pressure levels no greater than 130 dB in air, which equates to 156 dB underwater. Because such noise levels would occur only once and last no more than a fraction of a second, no impacts to terrestrial or marine species would be expected at other islets.

On Illeginni Islet, in-air peak sound pressure levels would range from approximately 156 dB (re 20  $\mu$ Pa) at the point of impact to 130 dB at the eastern end of the islet. Such noise levels are expected to cause some startle and temporary flush responses in birds, as indicated by the research data presented in Table 4-6 for impulsive noise effects on bald eagles (*Haliaeetus leucocephalus*). Research data identified to date only examined bald eagles; however, the hearing range and sensitivity for eagles should be similar to, and overlap appreciably with, other bird species.

**Table 4-6. Reactions of Bald Eagles to Peak Noise Levels for Impulsive Noise**

Response	Peak In-Air Noise Level
No Physiological Response	Less than 100 dB
No Response or Minor Physiological Response (i.e., head turn, body or wing movement, or vocalization)	100–126 dB
Minor Physiological Response or Take to Flight	126–160 dB <sup>1</sup>
Take to Flight or Temporary Flush	160 dB

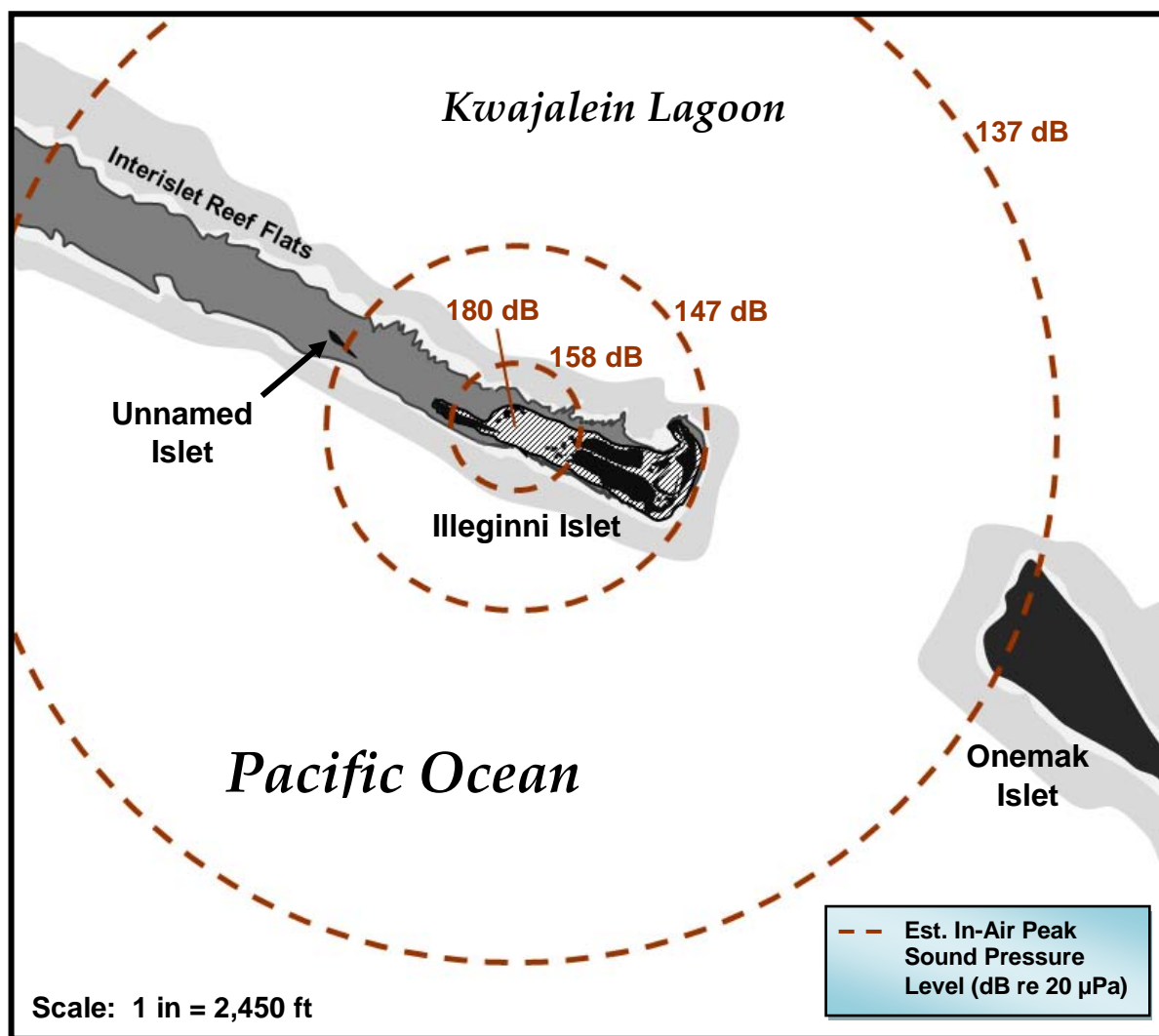
**Notes:**

<sup>1</sup> Effects for this range are an extrapolation of the lower and higher noise levels.

Source: Broska, 2008; Brown, et al., 1999

The sonic boom overpressures in the waters surrounding Illeginni Islet would range from approximately 156 to 173 dB (re 1  $\mu$ Pa) at the water's surface. Although sea turtles and marine mammals located near the shore could be subjected to these sound levels, the levels would be well below the 224 dB (re 1  $\mu$ Pa) peak pressure threshold for the onset of TTS (USN, 2008a, 2008b). The sonic boom effects at Illeginni Islet would have a negligible effect on marine mammals and sea turtles because the highest overpressures would be predominately confined to land, would generate minimal in-water footprints, and be very short in duration.

**Integrated Payload Aerial Detonation.** As the PDV approaches Illeginni Islet, the integrated payload would be activated. At a very low altitude just above the islet, the payload's high explosives package would detonate and disperse the particles over the intended impact site on the western end of Illeginni Islet. As shown in Figure 4-4, the maximum sound pressure level from this in-air explosion would be



**Figure 4-4. Estimated In-Air Noise Contours for the CSM Payload Detonation in the Vicinity of Illeginni Islet**

extremely loud, ranging up to 180 dB (peak pressure in air) at the impact site. Such pressure levels could be fatal to migratory birds in the impact area. Pre-test preparations to discourage birds from feeding and nesting in the impact area, however, would minimize this risk. With distance from the impact site, sound levels would rapidly attenuate. As shown on Figure 4-4, sound levels in the forested areas in the center and eastern side of Illeginni would range from about 147 dB to 158 dB peak pressure. Based on the data presented in Table 4-6, such sound levels are expected to cause temporary flush or minor physiological responses. On neighboring Onemak Islet to the east, sound levels of 137 dB or lower would inflict even less of a response on birds and other wildlife. Thus, no long-term impacts on local bird populations would be expected. This conclusion is supported by long-term studies at Vandenberg AFB and other military installations, where very loud noise levels from repeated rocket launches have generally not affected sea and shorebird populations (USAF, 2006).

If the detonation were to occur directly over water, the underwater overpressures would be as high as 206 dB (re 1  $\mu$ Pa) for peak pressure or 183 dB (re 1  $\mu$ Pa<sup>2</sup>-s) for energy flux density directly under the

detonation. The payload's detonation, however, would occur at a very low altitude over the islet, thus most of the acoustical energy would be confined to land. Within the waters surrounding Illeginni, underwater peak pressures would range from approximately 173 to 195 dB (re 1  $\mu$ Pa). The TTS and PTS thresholds for peak pressure and energy flux density would not be exceeded. Thus, the payload detonation overpressures would have "no adverse effect" on protected marine mammals and sea turtles in the offshore waters. This conclusion is supported by survey records that indicate few sightings of sea turtles and no sightings of marine mammals in the near-shore waters surrounding Illeginni Islet.

Within the shallow lagoon and ocean waters adjacent to Illeginni Islet, fish, mollusks, and other invertebrate species—including two species of protected top shell snails (*Trochus* species) and the protected black-lip mother of pearl oyster (*Pinctada margaritifera*)—would be subjected to the underwater sound from the aerial payload detonation. Research to date on the effects of sound on fish is limited in terms of the number of well-controlled studies and species tested. Moreover, there are limits in the range of data available for particular types of sound sources and with the behavior of fish in their natural environment. Available information on the effects of sound on mollusks and other invertebrates is even more limited than for fish. Because of the great variability in hearing capabilities and auditory structure for different species, thresholds for TTS, PTS, and mortality in fish or mollusks have not been established. The overall sound levels from the payload's detonation would be filtered by the inability of most marine fish species to hear sounds above 1.5 kilohertz. In addition, current research shows only the most limited mortality, and then only when species are very close to an intense sound source (USN, 2008a). Combined with the extremely short duration of the test event, and the distance to the water, there is little likelihood of injury or mortality in fish or mollusks occupying adjacent waters. Thus, the resulting noise levels from the proposed aerial detonation would have "no adverse effect" on the protected top shell snails and black-lip mother of pearl oyster.

At close range, the payload detonation over Illeginni Islet would cause a shockwave in the form of airborne vibrations that would contact the ground around the intended impact site. Although the shockwave could cause serious harm, few if any birds and other wildlife are expected to be in this area during the test event. Research has shown a strong correlation between peak sound levels, airborne vibrations, and their effects on structures (Siskind, 1989), but there are no buildings or major facilities on the western end of Illeginni Islet that could be affected. Although there has been very little research on the propagation of shockwaves through the air-water interface, the USAF did consider the potential for airborne vibration effects on the adjacent coral reef. As a rigid structure, portions of the reef that are at or just below the surface of the water could be affected by vibrations. These effects could range from brief rattling to minor cracking. Such impacts on the reef, however, are expected to be minimal because: (1) the coral reef would be further away from the point of detonation and subjected to lower vibration levels, and (2) the shallow waters covering the reef would both attenuate and partially reflect the airborne vibrations.

PDV and Payload Particle Impacts. Activation of the integrated payload on the PDV would disperse thousands of particles over the intended impact area just prior to ground impact. All or most of the particles are expected to hit the intended land impact area on the western end of Illeginni Islet. The CSM Program Office has no intention for particles to ricochet beyond this area; thus, such effects are expected to be minimal. The remaining portion of the PDV would also impact within the intended area.

Although the risk is low, up to a few hundred payload particles could hit beyond the intended impact area in adjacent trees, the lagoon, and/or in the ocean. During impact, *Pisonia* or other trees could receive minor damage from payload particles or other debris. Although migratory birds or nest eggs adjacent to the impact area could be killed or injured during impact, pre-test preparations to discourage birds from feeding or nesting in the immediate area would minimize the risk.

Any payload particles hitting beyond the intended impact area “may affect” threatened and endangered sea turtles or sea turtle nests along the adjacent beaches or in adjacent waters. Sea turtles that are hit by high velocity particles could be killed or injured and nests could be damaged. The risk for such occurrences, however, are considered low because: (1) pre-test actions include surveys for sea turtle nests, and (2) prior survey records indicate few sightings of sea turtles or sea turtle nests at Illeginni Islet.

As a reasonable and prudent measure to minimize the potential for sea turtle nests to be destroyed by the PDV impact, the USFWS specified in their BO (Appendix F) that the USAF would “aim” the PDV’s terminal flight path away from known sea turtle nesting areas within the USAKA/RTS Mid-Atoll Corridor Impact Area, which includes the nesting areas at Illeginni Islet.

Payload particles hitting areas of managed vegetation on Illeginni Islet would penetrate the sandy soil to a shallow depth with little or no impact. However, any particles hitting patches of coral reef in the shallow waters (no more than a few feet deep) could pierce or bury into the reef, resulting in bullet-size holes. Because of the low risk for such an occurrence and the likelihood for minimal peripheral damage around the holes, the potential for adverse impacts on the coral reef would be minimal.

Also found within the shallow-water reef areas are two species of protected top shell snails and the protected black-lip mother of pearl oyster. Payload particles impacting the reef area “may affect” these species, most likely killing them if they were hit. However, the risk for such impacts on these species is low because: (1) the low probability for particles to impact adjacent waters, (2) the expectation for limited numbers of these species to occur in the shallow waters around Illeginni, and (3) the limited amount of peripheral damage that would occur around each particle impact point.

On the ocean-side of Illeginni Islet, schools of fish are common. The potential for fish to be harmed by high velocity particles hitting the deeper water, however, is low. After penetrating several feet of water, the particles would lose most of their kinetic energy and present little risk to fish and other marine life.

The effects of ground-borne vibrations from the PDV and payload particle impacts on the coral reef and marine life would be minor. Physical damage to the ground and adjacent topographical feature would be limited to the area directly adjacent to the impact site. Upon impact on the islet, the remaining portion of the vehicle potentially could form a crater of up to 20 to 25 ft (6.1 to 7.6 m) across. The force of impact and resulting crater would be similar to that of prior ICBM hypersonic vehicle tests at Illeginni (USAF, 2004). Although multiple ICBM tests have impacted the islet and shallow waters over the years, there have been no noticeable fractures or other changes to the islets substrate and no widespread impacts to the coral reefs that are directly attributed to the flight tests. This is consistent with studies that show the effects from vibration (due to demolition-type activities) and ground impacts are predominantly related to airborne, not ground borne vibration (Argonne National Laboratory, 1993; US Bureau of Mines, 1980).

Contamination of Seawater. As described in Section 2.1.1.2, the PDV would contain some hazardous materials consisting of small quantities of toxic metals, batteries, and explosive devices. During payload detonation and PDV impact, the vehicle would break up. Fugitive toxic-metal dust entering the ocean or lagoon seawater would be rapidly diluted. Because Be, Cr, Ni, and other metals used for PDV/payload components are generally insoluble in water, there would be no toxicity effects on fish and other marine species. If any of the PDV lithium battery electrolytes enter the water, wave action and currents would rapidly dilute the materials to non-toxic levels.

Because of only one flight test, a limited area of effects, and the implementation of precautionary measures during pre-test preparations, no significant impacts to protected terrestrial and marine species are expected to occur during terminal flight and impact activities.

## BOA Alternative

Carpet Boom Overpressures. Just as for the Preferred Alternative, the PDV would create a sonic boom along its flight path over the Marshall Islands. For the BOA Alternative flight path, the carpet boom would likely be audible on Utirik, Taka, Ailuk, and Likiep Atolls, and on Jemo Islet. Like the Preferred Alternative, however, the carpet boom would have negligible effects on terrestrial and marine species.

Focused Boom Overpressures. Within the BOA impact area, a focus boom would occur entirely over international waters, similar to that of the HTV-2 flight tests previously analyzed in the HTV-2 EA (USAF, 2009b). Predicted overpressures at ocean level would range from about 0.06 psf along the outer edges of the sonic boom footprint to approximately 26 psf near the point of ocean impact (see Figure 4-3). For such overpressures, the equivalent underwater sound level at the air-to-water interface would range from a low of about 129 dB (re 1  $\mu$ Pa) to a maximum of approximately 182 dB (re 1  $\mu$ Pa).

Based on prior consultations for the HTV-2 program, the NMFS determined that the HTV-2 vehicle's focused boom would exceed the TTS and PTS thresholds for cetaceans. These effects, however, would generate minimal in-water sonic boom footprints in the BOA and the potential exposure would last for only a fraction of a second per flight test event. Based on the limited area and duration of potential exposure to adverse sound levels, and the belief that ESA-listed marine mammal and sea turtle species densities in the BOA are low and patchy in distribution, the NMFS considered the potential acoustical effects to be discountable. The USAF assumes similar findings for other marine mammal species as well.

Integrated Payload Aerial Detonation. As the PDV approaches the barges in the BOA, the integrated payload would be activated. At a very low altitude just above the barges' location, the payload's high explosives package would detonate and disperse the particles. Just as for the Preferred Alternative, the maximum sound pressure level from this in-air explosion would be extremely loud, ranging up to 180 dB (peak pressure in air).

The underwater peak overpressures would be as high as 206 dB (re 1  $\mu$ Pa) directly under the detonation. These peak levels would be well below the 224 dB (re 1  $\mu$ Pa) peak pressure threshold for the onset of TTS in marine mammals and sea turtles (USN, 2008a, 2008b). The energy flux density for the detonation event, however, would be 183 dB (re 1  $\mu$ Pa) directly under the detonation. This would exceed the 182 dB (re 1  $\mu$ Pa) energy flux density threshold for the onset of TTS, but would be below 205 dB (re 1  $\mu$ Pa) energy flux density threshold for the onset of PTS (USN, 2008a).

Thus, the effects of the payload's detonation in the BOA would have a minor effect on marine mammals and sea turtles because: (1) the overpressures would generate minimal in-water footprints and be very short in duration; (2) underwater sound levels would exceed energy flux density thresholds for TTS in an extremely limited area directly under the detonation; (3) underwater sound levels would not exceed thresholds for PTS; and (4) ESA-listed marine mammal and sea turtle species are believed to have low and patchy densities within the ROI.

PDV and Payload Particle Impacts. Activation of the integrated payload on the PDV would disperse thousands of particles over the barges just prior to impact. A large portion of the particles are expected to hit the barges, but many could still enter the surrounding water. The remaining portion of the PDV would most likely impact the barges, although it could potentially impact directly in the surrounding water. All debris entering the water is expected to sink. Although highly unlikely, any marine mammals or sea turtles in proximity of the barges would be killed by the particles or other PDV debris.

If the remaining PDV impacts directly in the water, an underwater shock/sound wave would result, comparable to the splashdown of the rocket motors described in Section 4.1.2.2.2, but with much greater

force because of the vehicle's hypersonic velocity at the time of impact. Such shock/sound waves produce impulse or impact types of underwater noise similar to that of explosives. Any marine mammals or sea turtles within several yards of the point of vehicle impact would most likely be injured or killed. As the shock/sound wave radiates away from the impact point, sound levels would decrease, as would the risk for injury or auditory effects. Using the dual-exposure criteria (peak pressure and energy flux density) approach described in Section 4.1.2.2.2, Table 4-7 presents the estimated radial distances for the onset of TTS and PTS from the PDV point of ocean impact, which are very similar to that of the HTV-2 flight tests previously analyzed in the HTV-2 EA (USAF, 2009b).

<b>Table 4-7. Estimated Underwater Radial Distances for the Onset of TTS and PTS in Marine Mammals and Sea Turtles from PDV Ocean Impacts</b>			
<b>Potential Effect</b>	<b>Criterion</b>	<b>Criterion Source</b>	<b>Radial Distance from Impact Point ft (m)</b>
PTS	230 dB (re 1 $\mu$ Pa) peak pressure	USN, 2008b	31 (9.4)
	205 dB (re 1 $\mu$ Pa <sup>2</sup> -s) energy flux density	USN, 2008a	190 (57.9)
TTS	224 dB (re 1 $\mu$ Pa) <sup>1</sup> peak pressure	USN, 2008a, 2008b	61 (18.6)
	182 dB (re 1 $\mu$ Pa <sup>2</sup> -s) energy flux density	USN, 2008a	2,690 (819.9)

Notes:

<sup>1</sup> A peak pressure of 224 dB (re 1  $\mu$ Pa) is equivalent to 23 psi.

Based on prior consultations for the HTV-2 program, the NMFS determined that the underwater impacts are discountable because there would be a limited number of test events and because of the expected low density of ESA-listed species within the BOA. The USAF assumes similar findings for other marine mammal species as well.

Contamination of Seawater. As previously described, the PDV would contain some hazardous materials, consisting of small quantities of toxic metals, batteries, and explosive devices. During payload detonation and impact at the barge location, the vehicle would break up and release the hazardous materials. The barge hulls and up to four of the onboard hydraulic power units also could be damaged during the impact, which might result in the release of battery electrolytes; up to several gallons of engine coolant, oil, and/or hydraulic fluid; and up to 150 gallons (566 liters) of diesel fuel. Any fugitive toxic-metal dust, battery electrolytes, or engine fluids entering the seawater would be rapidly diluted. No floating debris is expected and all PDV components entering the water would sink thousands of feet to the ocean floor, out of reach of marine mammals, sea turtles, and most other marine life. On the ocean floor, it is possible for benthic species to be adversely affected by contaminants in the PDV debris, but such impacts would be localized to within a short distance of the debris.

Because of only one flight test, a limited area of effects, the implementation of precautionary measures during pre-test preparations, and low animal-densities in the BOA, no significant impacts to protected marine species are expected to occur during terminal flight and impact activities.

#### **4.1.3.3.3 Post-Test Operations**

##### **Preferred (Land Impact) Alternative**

Post-test recovery and cleanup operations at Illeginni Islet would not induce further impacts on migratory birds or other species on the islet. So as not to further impact the surrounding soil and vegetation, only freshwater would be used for wetting/washing down the impact area. To minimize long-term risks to birds and marine life, all visible payload particles and other PDV debris would be recovered. For the recovery of particles or other debris that penetrates the sandy soil, metal detectors and hand digging tools may be used. This would include the recovery of visible debris in the shallow lagoon or ocean waters by range divers. Should any debris impact in areas of sensitive biological resources (i.e., forested areas, sea turtle nesting habitat, and coral reef), then USFWS and NMFS biologists would provide guidance and/or assistance in recovery operations to minimize impacts on such resources. In all cases, hand tools would most likely be used.

USAKA/RTS personnel would conduct a helicopter or fixed-wing aircraft overflight of the islet vicinity within several hours after the test to survey for any dead or injured marine mammals and sea turtles. Within 1 day after the test, USAKA/RTS, USFWS, and/or NMFS biologists would survey Illeginni Islet and the near-shore waters for any injured wildlife or damage to sensitive habitats. In addition, USFWS and NMFS biologists would assist USAKA/RTS in the recovery and rehabilitation of any injured migratory birds or sea turtles found at Illeginni. During inspections of the islet, biologists would assess any sea turtle mortality. As specified in the USFWS BO in Appendix F, the USAF would submit a report to USAKA/RTS at the end of the calendar year (in which the CSM Demonstration test occurs) that describes any sea turtle take that may have occurred at Illeginni Islet. The USAKA Environmental Management Office would then forward the report to the Pacific Islands Fish and Wildlife Office, suggesting ways to further minimize incidental take at Illeginni Islet.

Prior to test implementation, the USAF would consult with the USFWS and NMFS in the preparation of a detailed recovery/cleanup plan that outlines all post-test recovery activities and procedures for operations at Illeginni Islet. In all cases, recovery and cleanup operations would be conducted in a manner to minimize further impacts on biological resources.

Prior to returning the test support equipment and materials to the US, the equipment would be washed and a certified Pest Control Technician would inspect the equipment again to ensure that it does not contain any insects, animals, plants, or seeds that might have been picked up during fielding.

In their BO regarding effects on nesting habitat for green and hawksbill sea turtles (see Appendix F), the USFWS determined that the Proposed Action is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for these species; therefore, none would be affected. Because of the potential to harm sea turtle nests, the USFWS included an incidental take statement in the BO. The USFWS anticipates incidental take to occur in the form of harm or harassment to the breeding success or loss of up to three sea turtle nests, or the injury or loss of up to 390 eggs or hatchlings, as a result of project-related PDV impacts at Illeginni Islet.

To compensate for potential impacts to sea turtle nests at Illeginni, the USAKA/RTS would implement steps to eradicate rodents on Eniwetak Islet (depending on the results of a rodent population assessment) or on Gellinam Islet. Removing rodents from one of the islets, which are located on the eastern side of Kwajalein Atoll, would help protect sea turtle nests from depredation of eggs and hatchlings. Specific steps for implementing the rodent eradication are provided in the BO. Although such losses identified in the incidental take statement are not likely to occur, it is expected that they would be offset by the implementation of conservation measures for turtle nesting habitat at Eniwetak or Gellinam.



Through implementation of the mitigation measures described above, post-test operations at USAKA/RTS are not expected to have a significant impact on protected terrestrial and marine species or their habitats. In addition, as part of the DEP process described earlier in Section 1.8, the USAF and USASMDC/ARSTRAT will continue coordination and consultations with USFWS, NMFS, USEPA, US Army Corps of Engineers, and the RMIEPA, to clarify current mitigation measures and determine whether any additional mitigation measures are warranted.

## **BOA Alternative**

Ocean travel and the recovery of the barges and free-floating rafts from the BOA would be conducted in a similar manner as during their initial deployment (see Section 4.1.3.3.1). Vessel operations are not expected to have a significant impact on marine mammals and sea turtles. No floating debris from the PDV ocean impact is expected. If ship personnel were to find floating debris from the vehicle, it would be collected for proper disposal.

As described in Section 4.1.3.1.3, test support personnel would wet or wash down the barge decks to eliminate the potential for HAPs or other fugitive dust. Although the wash water could contain particles of toxic metals and would drain directly into the ocean, the wash water would be rapidly mixed and diluted in the seawater. If the BOA Alternative were to be selected for implementation, the USAF would prepare a detailed cleanup plan that satisfies human health and safety requirements and incorporates measures to minimize ocean pollution.

If damage to any one of the barge hulls is too extensive, preventing it from being towed back to USAKA/RTS, then personnel would place a small explosives charge on the damaged barge to sink it in place. Prior to sinking the damaged barge, personnel would attempt to recover remaining fluids (i.e., diesel fuel, engine coolant, oil, and hydraulic fluid) and batteries from any onboard hydraulic power units, and test equipment/materials from the deck, and load them onto the other barges or support vessels. Materials would be removed from the damaged barge only if it is feasible and can be conducted safely. Additionally, the barge would only be scuttled after the area is determined to be clear of marine mammals and sea turtles out to a safe distance that is based on the intended explosives. The damaged barge would sink thousands of feet to the ocean floor. Any floating debris would be collected for proper disposal in accordance with USAKA/RTS policies and procedures.

Although unlikely, any dead or injured marine mammals or sea turtles sighted during recovery operations would be reported to the USAKA Environmental Management Office, which would then inform the NMFS in Honolulu. USAKA/RTS aircraft pilots operating in the vicinity of the impact and test support areas near Roi-Namur Islet would also report any opportunistic sightings of dead or injured animals.

Just as during pre-test preparations, post-test operations are not expected to have a significant impact on protected marine species.

### **4.1.3.4 Health and Safety**

#### ***4.1.3.4.1 Pre-Test Preparations and Support***

For both the Preferred Alternative and BOA Alternative, pre-test preparations at USAKA/RTS would not introduce new types of activities or increase levels of risk to personnel. Setup activities on Illeginni Islet or in the BOA would not expose personnel to hazardous materials or to harmful noise levels. Vessel operations, particularly in the BOA, would only occur when weather and sea conditions were acceptable for safe travel.

Use of existing tracking radars and sensors would continue in accordance with ongoing support activities. Prior analyses of the radars and sensors at USAKA/RTS determined that there would be no significant impacts to workers and the public from non-ionizing (radio frequency) radiation because of operational safety procedures in place (USASSDC, 1993).

Thus, pre-test preparations would not have a significant impact on health and safety.

#### **4.1.3.4.2      *Terminal Flight and Impact Activities***

Through the application of USAKA/RTS range safety requirements described in Section 3.3.4, test programs are conducted with minimal risk to military personnel, contractors, and the general public. For the CSM Demonstration flight test, safety personnel at both Vandenberg AFB and USAKA/RTS would closely coordinate development of risk analyses based upon the trajectory, probability for system failure, and the population density of islets near the flight path. Computer-monitored destruct lines, based on no-impact lines, are pre-programmed for the Flight Safety software to avoid any falling debris on inhabited areas consistent with Space System Software Safety Engineering protocols and US range operation standards and practices. As Figure 2-5 shows, the representative terminal flight paths for both alternatives (Preferred Alternative and BOA Alternative) would avoid overflight of RMI communities. For the Preferred Alternative, precautions within the Mid-Atoll Corridor Impact Area at USAKA/RTS may include evacuating nonessential personnel and sheltering all other personnel remaining within the Mid-Atoll Corridor. The USAKA/RTS Safety Office would not allow the CSM Demonstration flight test to proceed if the calculated risk exceeds the RCC 321-07 criteria, which requires that individuals within the general public not be exposed to a probability of casualty greater than 1 in 1,000,000 for any single mission.

As described in Section 3.3.4, NOTMARs and NOTAMs would be issued prior to the flight test to warn mariners and pilots to avoid the selected impact area. Only mission-essential vessels would be allowed in the vicinity of the impact area. Radar sweeps by USAKA/RTS land-based and sea-based sensors (e.g., USAV Worthy), in addition to visual surveys by ship personnel, would help to ensure that the PDV impact area is clear of non-mission ships and aircraft prior to tests.

As a result, PDV terminal flight activities and impact for either alternative are not expected to have a significant impact on health and safety.

#### **4.1.3.4.3      *Post-Test Operations***

Just as for pre-test preparations, vessel operations would only occur when weather and sea conditions were acceptable for safe travel. For both alternatives (Preferred Alternative and BOA Alternative), UXO personnel would first clear the impact site (Illeginni Islet or the ocean barges) for safe access. Test support personnel entering the impact site would wear proper PPE, as necessary. In addition, personnel would implement precautionary procedures to control fugitive dust by wetting or washing down the impact area. If under the BOA Alternative, a damaged barge must be sunk in place because of navigational safety concerns, then only trained explosives demolition personnel would set the charge on the barge. Prior to scuttling the barge, USAKA/RTS would alert the RMI Government on the circumstances for the action. Thus, post test operations for either alternative would not have a significant impact on health and safety.

#### 4.1.3.5 Hazardous Materials and Waste Management

##### 4.1.3.5.1 *Pre-Test Preparations and Support*

Other than the use of fuels and lubricants for operating transportation and other support equipment, there would be limited use of hazardous materials at USAKA/RTS in support of either alternative (Preferred Alternative or BOA Alternative). Portable sensors at Illeginni Islet would operate on small batteries, but none of the test equipment and materials placed on the islet would contain fuels, oils, pressurized gases, propellants, ordnance, or other hazardous materials. Just as at Illeginni Islet, the test equipment and materials placed on the barges in the BOA would not contain hazardous materials. Only the hydraulic power units, control systems, and sensors onboard the barges would contain batteries and engine fluids (i.e., diesel fuel, coolant, oil, and hydraulic fluid).

As identified in Section 3.3.5, accidental spills from support equipment operations would be contained and cleaned up in accordance with KEEP requirements. All hazardous and non-hazardous wastes would be properly disposed of in accordance with the UES. Hazardous material and waste-handling capacities would not be exceeded, and management programs would not have to change. As a result, no significant impacts from hazardous materials and waste management would occur.

##### 4.1.3.5.2 *Terminal Flight and Impact Activities*

Impact of the PDV on land at Illeginni Islet or on the barges in the BOA would introduce various hazardous materials, primarily batteries and heavy metal components, including approximately 0.35 ounces (10 g) of Be, 4.0 lb (1.8 kg) of Cr, and 10.3 lb (4.7 kg) of Ni. Although highly unlikely, small pieces of the high explosives from the integrated payload might also remain intact.

During impact, the PDV and the payload particles could partially disintegrate into fugitive dust around the impact site and a short distance downwind. If deposited into the soil on Illeginni Islet, the expected concentration of toxic heavy metals would be very low. For example, if all of the Cr and Ni components in the PDV were to disintegrate into dust and be deposited over the designated impact area, the expected concentration of these metals in the top 1-in (2.5-cm) layer of soil would be 10 mg/kg for Cr and 26 mg/kg for Ni.<sup>12</sup> Compared to the 2009 USEPA (Region 9) Regional Screening Levels for these two metals in residential soil—120,000 mg/kg for Cr and 3,800 mg/kg for Ni (USEPA, 2010)—the maximum potential concentrations on Illeginni Islet would be far below toxic concentrations for humans.

For the Preferred Alternative on Illeginni Islet, impact of the remaining portion of the PDV could form a crater, similar to that formed by the prior ICBM flight tests (up to 20 to 25 ft [6.1 to 7.6 m] across) (USAF, 2004). Should the PDV impact in unpaved areas, soil containing residual concentrations of Be and DU (a result of the ICBM flight tests) would be scattered over the test impact area. However, as described in Section 3.3.5, comprehensive soil analyses have shown that the concentrations of Be and U on Illeginni Islet are statistically similar to the natural background concentrations found in soils on other coral atolls in the northern Marshall Islands and at other global locations (Robison, 2005, 2006).

For the BOA Alternative, the PDV's impact on the ocean barges could also damage one or more of the four hydraulic power units, which might result in the release of battery electrolytes; up to several gallons of engine coolant, oil, and/or hydraulic fluid; and up to 150 gallons (566 liters) of diesel fuel. Although the engine fluids could potentially drain into the ocean, the fluids would be rapidly mixed and diluted in the seawater.

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<sup>12</sup> Concentration estimates assume the bulk density of coral soil is 1,100 kg/m<sup>3</sup> and the total volume of affected soil is 164.3 m<sup>3</sup>.

As described in Section 4.1.3.5.3, post-test recovery, cleanup, and disposal actions would ensure that no significant impacts from hazardous materials and waste management would occur.

#### **4.1.3.5.3 Post-Test Operations**

##### **Preferred (Land Impact) Alternative**

Prior to recovery and cleanup actions on Illeginni Islet, UXO personnel would first survey the impact site for any residual explosive materials. If found, such materials would be collected for safe disposal. As described in Section 4.1.3.1.3, test support personnel entering the impact site would also implement precautionary procedures to control fugitive dust by wetting or washing down the impact area using fresh water. Following removal of all support equipment and any remaining debris from the impact site, the crater would be backfilled and, if necessary, repairs made to surrounding structures. Just as during the pre-test preparations, accidental spills from support equipment operations would be contained and cleaned up in accordance with KEEP requirements. All waste materials would be returned to Kwajalein Islet for proper storage and disposal in accordance with the UES standards. Hazardous waste and other waste-handling capacities at USAKA/RTS would not be exceeded, and management programs would not have to change. Prior to test implementation, the USAF would prepare a detailed recovery/cleanup plan that outlines all post-test recovery activities and procedures for operations at Illeginni Islet.

Because existing Be and DU concentrations in the soil on Illeginni Islet are similar to natural background concentrations, and any additional heavy metal deposition from the PDV would result in soil concentrations well below USEPA (Region 9) standards for residential soil, the USAF expects that no post-test soil sampling or monitoring would be necessary as part of the Proposed Action.

As a result, no significant impacts from the management of project-related hazardous materials and waste are expected.

##### **BOA Alternative**

Similar to the Preferred Alternative at Illeginni Islet, post-test activities on the ocean barges would include UXO clearance; conducting an impact assessment of the barges and test equipment on the deck; recovery of visible PDV and payload particle debris, including hazardous materials; and wetting or washing down the barge decks. Although the wash water draining into the ocean could contain particles of toxic metals, battery electrolytes, and/or engine fluids (i.e., diesel fuel, engine coolant, oil, and hydraulic fluid), the wash water would be rapidly mixed and diluted in the seawater. As part of cleanup, personnel would recover any engine fluids remaining in damaged hydraulic power units to avoid further leakage. If the BOA Alternative were to be selected for implementation, the USAF would prepare a detailed recovery/cleanup plan that satisfies human health and safety requirements and incorporates measures to minimize ocean pollution.

If a damaged barge cannot be towed back to USAKA/RTS for repairs, then personnel would use a small explosives charge to sink it in place. Prior to sinking the damaged barge, personnel would attempt to recover remaining engine fluids and batteries from any onboard hydraulic power units. Materials would be removed from the damaged barge only if it is feasible and can be conducted safely.

All waste materials collected would be returned to USAKA/RTS for proper storage and disposal in accordance with the UES standards. Hazardous waste and other waste-handling capacities at USAKA/RTS would not be exceeded, and management programs would not have to change. Thus, no significant impacts from the management of project-related hazardous materials and waste are expected.

## 4.2 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

Under the No Action Alternative, the CSM Demonstration flight test would not be implemented at Vandenberg AFB or at USAKA/RTS. As a result, there would be no CSM Demonstration related environmental impacts from facility modifications, launch activities, or terminal flight operations. Vandenberg AFB and USAKA/RTS would continue ongoing operations with environmental conditions expected to remain unchanged from that described for the Affected Environment in Chapter 3.0 of the EA.

## 4.3 CUMULATIVE EFFECTS

Cumulative effects are considered to be those resulting from the incremental effects of an action when considering past, present, and reasonably foreseeable future actions, regardless of the agencies or parties involved. In other words, cumulative effects can result from individually minor, but collectively potentially significant, impacts occurring over the duration of the Proposed Action and within the same geographical area.

The following sections describe the potential for cumulative impacts to occur at Vandenberg AFB, at USAKA/RTS and elsewhere in the Marshall Islands, and within the global environment as a result of implementing the proposed CSM Demonstration flight test.

### 4.3.1 VANDENBERG AIR FORCE BASE

The proposed Minotaur IV Lite launch would be conducted in a manner similar to that of other launch systems in use at Vandenberg AFB. Table 4-8 shows the CY 2010 launch rate forecast for all programs at Vandenberg AFB other than CSM. Beyond CY 2010, similar launch rates are expected. For the CSM Demonstration, only one Minotaur IV Lite launch would be conducted within the CY 2012 timeframe. Thus, the proposed CSM Demonstration launch represents an approximate 7 percent increase in the number of launches per year (on average) at Vandenberg AFB.

<b>Table 4-8. Launch Rate Forecast for Vandenberg AFB, CA</b>	
<b>Launch System</b>	<b>Calendar Year 2010</b>
Atlas V	1
Delta II	3
Delta IV	1
Falcon	0
Taurus	0
Minotaur	2
Minuteman	3
BMDS Programs	4
Pegasus	0
<b>Launch Rate Total</b>	<b>14</b>

Source: Edwards, 2009

The potential for cumulative impacts to occur at Vandenberg AFB is discussed in the following paragraphs for each affected resource.

Air Quality. Under the Proposed Action, a minor temporary increase in air emissions would occur, primarily from site modifications, pre-launch, and launch activities. Additionally, other projects and activities would occur at Vandenberg AFB and within the region, resulting in some measurable amounts of air pollutants. The State of California and Santa Barbara County take into account the effects of all past, present, and reasonably foreseeable activities during the development of their State Implementation Plan (as required by the Clean Air Act) and County Clean Air Plan. Estimated emissions generated by the Proposed Action would be below *de minimis* levels and conform completely to these plans. Therefore, implementation of the Proposed Action would not contribute to adverse cumulative air quality impacts.

The proposed Minotaur IV Lite booster would generate fewer emissions than the larger spacelift systems (e.g., Atlas and Delta) in use at the base. In addition, the CSM Demonstration launch and other rocket launches represent short-term, discrete events that would occur at different times and at different locations across Vandenberg AFB. The emissions would not accumulate because winds quickly and effectively disperse them. Consequently, no significant cumulative impacts to air quality are anticipated.

Noise. While the CSM Demonstration launch would occur from TP-01, other launch programs would be conducted from multiple locations across the Vandenberg AFB. The Minotaur IV Lite launch vehicle would generate lower noise levels per launch, when compared to the larger spacelift systems in use (e.g., Atlas and Delta). Despite the increase in number of launch events, the noise generated by the CSM Demonstration launch would be very brief and would not have a perceptible impact on cumulative noise metrics, such as the CNEL. Thus, implementation of the CSM Demonstration flight test at Vandenberg AFB is not expected to result in any significant cumulative impacts on noise.

Biological Resources. The proposed CSM Demonstration launch would increase the overall number of rocket launches at Vandenberg AFB by approximately 7 percent for one year, resulting in an increase in launch noise and rocket emissions released. The CSM Demonstration and other program launches represent short-term, discrete events that would occur at different times and at different locations across the base. Through coordination and consultations with the USFWS and the NMFS, the USAF implemented various plans and measures to limit the extent and frequency of potential impacts on protected and sensitive species. In addition, monitoring of certain species during launches is conducted on a regular basis to ensure that no long-term or cumulative impacts occur. To address the short-term disturbance of threatened and endangered species under the Proposed Action, the USAF would comply with the requirements specified in the USFWS BO provided in Appendix D. For the harassment of marine mammals (pinnipeds), the NMFS granted a take permit for Vandenberg AFB that covers a forecast of up to 30 launches per year. As discussed earlier and shown in Table 4-8, the addition of one CSM Demonstration launch would not cause the take permit forecast limit to be exceeded.

Although the CSM Demonstration actions would result in an increase in the number of short-term impact events at the range, no long-term cumulative effects on biological resources are anticipated. Consequently, no significant cumulative adverse effects on threatened and endangered species or sensitive habitats are expected to occur.

Cultural Resources. Vandenberg AFB has an Integrated Cultural Resources Management Plan already in place for the long-term protection and management of cultural resources that occur on the base. In accordance with Federal and state regulations, and agreements with the California SHPO, Vandenberg AFB personnel also regularly coordinate and consult with the SHPO and Native American specialists prior to implementing new projects where historical, archaeological, or traditional resources could be affected. As part of normal procedures, workers are informed of the sensitivity of cultural resources and the mitigation measures that might be required if sites are inadvertently damaged or destroyed, and

security forces regularly patrol the base to help prevent potential vandalism and looting of such resources. Because of the requirements and procedures already in place, and the limited potential for proposed CSM Demonstration activities to affect cultural resources on base, implementation of the CSM Demonstration at Vandenberg AFB is not expected to result in any significant cumulative impacts on these resources.

Coastal Zone Management. Vandenberg AFB contains over 35 mi (56 km) of coastline consisting of a variety of natural communities, resources, and recreation areas. The base has taken many steps to protect and maintain coastal resources in collaboration with Federal, state, and local agencies. This includes funding for research of marine mammals on base, enforcing the limited access regulations to key wildlife areas on base, and minimizing the closure of public beaches.

As previously discussed, the launch rate forecast for Vandenberg AFB over the next few years is expected to be around 14 launches per year. Depending on the launch site and flight trajectory, each launch may require the closure of public beach areas. For example, Point Sal State Beach is closed on average 12 times a year (Ornelaz, 2009). Although the number of beach closures could increase slightly from the additional CSM Demonstration flight test, the increase in closures would be minimal, short term, and have no major effect on local recreation.

Vandenberg AFB personnel regularly consult with the CCC prior to implementing new projects that might affect the policies of the CCA. As a result, implementation of the CSM Demonstration activities at Vandenberg AFB is not expected to result in significant cumulative impacts on Coastal Zone Management.

Water Resources. The proposed CSM Demonstration activities, when combined with other planned base activities, would not have any adverse effects on water resources. No other future programs have been identified that, when combined with the proposed activities, would contribute to cumulative water resources impacts. All construction and operations would be conducted in accordance with Federal and state water resource regulations.

Health and Safety. On Vandenberg AFB, all projects must comply with applicable standards, policies, and procedures for health and safety. All rocket launches and other hazardous operations are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, military personnel, and contractors. Because implementation of the CSM Demonstration would also comply with these same requirements, no significant cumulative impacts to health and safety are expected to occur.

Hazardous Materials and Waste Management. The cumulative generation of solid waste from CSM Demonstration-related facility modifications and construction activities, in addition to other planned construction and demolition projects on base, has the potential to exceed the permitted disposal tonnage on base. Coordination of implementation schedules for these projects and appropriate tracking of disposal tonnage would ensure that permitted disposal amounts at the base landfill are not exceeded.

In addition, implementing the CSM Demonstration at Vandenberg AFB would not introduce new hazardous materials and wastes, and only a small increase in wastes would be expected from the proposed launch. Therefore, no significant cumulative impacts from the management of hazardous materials and waste are anticipated.

#### **4.3.2 OVER-OCEAN FLIGHT CORRIDOR AND THE GLOBAL ENVIRONMENT**

Global Atmosphere. On a global basis, the CSM Demonstration launch would release negligible quantities of HCl and Cl emissions. Solid rocket motors make a relatively small contribution to stratospheric ozone depletion, which is dominated by the release of CFCs and Halons from other sources.

As for effects on global warming, the overall CSM Demonstration would release a small quantity of CO<sub>2</sub> compared to anthropogenic releases worldwide and the CEQ's draft threshold guidance. The limited amount of emissions would not contribute significantly to cumulative ozone depletion or global warming; however, any emissions of ozone depleting substances or GHG represent an incremental increase that could have incremental effects on the global atmosphere.

**Biological Resources.** Potential cumulative impacts on marine life in the open ocean could occur from the additional CSM Demonstration launch, over and above projected launches identified in Table 4-8. Although Minotaur IV Lite booster and PDV sonic booms could affect the behavior and hearing of marine mammals and sea turtles, the noise levels would be very short in duration at any given location and they would affect open ocean areas believed to have low and patchy densities of protected species. The sonic booms over the NWHI also would be minimal in strength and would occur only once.

There would be a slight increase in the risk for spent booster motors to strike marine life in the open ocean, but again, protected marine mammal or sea turtle species are widely scattered and the probability for debris to strike an animal is very remote. The resulting shock/sound wave produced by the spent rocket motors as they impact the water could cause injury or death to animals close to the impact point and could lead to potential hearing loss in other animals nearby. However, the probability for such an occurrence is very low, considering the limited number of launches, the relatively low population distribution of animals in the open ocean, and the small size of the ocean areas affected by each launch. Thus, no significant cumulative impacts to marine life are anticipated.

#### 4.3.3 US ARMY KWAJALEIN ATOLL/REAGAN TEST SITE AND THE MARSHALL ISLANDS

The proposed CSM Demonstration flight test would be conducted in a manner similar to that of the USAF's ongoing ICBM hypersonic reentry vehicle tests conducted at USAKA/RTS (USAF, 2004). Although several ICBM reentry vehicles are tested each year, land impacts on Illeginni Islet occur on average once every 4 or 5 years. Currently, no ICBM test land impacts are planned at Illeginni Islet at least through 2012 (Ramanujam, 2009). In addition, the US Army proposes to flight test the Advanced Hypersonic Weapon (AHW)—another potential CPGS system—at Illeginni Islet within the next few years. Table 4-9 shows the CY 2010 to 2012 hypersonic vehicle flight test forecast for all programs at USAKA/RTS other than CSM.

<b>Table 4-9. Hypersonic Vehicle Flight Test Rate Forecast for USAKA/RTS</b>			
<b>Test Program</b>	<b>Calendar Year</b>		
	<b>2010</b>	<b>2011</b>	<b>2012</b>
MM-III Reentry Vehicle	4	5 <sup>1</sup>	5 <sup>1</sup>
HTV-2 Vehicle	2	0	0
AHW Vehicle	0	1	0
<b>Total Number of Test Vehicles</b>	<b>6</b>	<b>6</b>	<b>5</b>

**Notes:**

<sup>1</sup> Test vehicle number represents average from earlier forecast data.

Source: Hasley, 2009; USAF, 2004, 2009



For the CSM Demonstration, only one flight test would be conducted within the CY 2012 timeframe. Thus, the proposed CSM Demonstration launch represents a 17 to 20 percent increase in the overall number of hypersonic vehicle flight tests conducted per year at USAKA/RTS. Discussions on each affected resource are provided in the following paragraphs.

Air Quality. Under the Proposed Action, minor temporary increase in air emissions would occur, primarily from the pre-test preparation, post-test operational activities, and the impact itself. Additionally, other projects and activities would occur at USAKA/RTS, resulting in some measurable amounts of both criteria pollutant and HAPs. None of these activities are expected to violate the UES standards, or generate criteria air pollutants or HAPs that would not rapidly dispersed. Therefore, implementation of the Proposed Action alone or in combination with other activities would not have adverse cumulative air quality impacts.

Noise. Depending on the alternative selected (Preferred Alternative or BOA Alternative), the resulting PDV sonic booms (carpet and focus booms) would affect RMI communities on Kwajalein, Likiep, Ailuk, and/or Utirik Atoll, but only once within each community. Very few other USAKA/RTS-related flight test have been identified that would produce additional sonic booms in these same areas. The noise from the CSM Demonstration flight test would constitute a minute incremental increase in the level of noise at these locations. However, no significant cumulative noise impacts to the RMI communities would occur.

Biological Resources. For the Preferred Alternative, the combination of CSM Demonstration with the AHW and MM-III flight tests could result in potential cumulative impacts for migratory birds on Illeginni Islet because of pre- and post-test activities, acoustic overpressures, and test vehicle/debris impacts. The implementation of actions to discourage nesting, however, would minimize impacts on birds. Although potential impacts to sea turtle nesting sites is possible, the limited number of recorded nests on the islet, in addition to the implementation of monitoring and conservation measures to protect sea turtle nests, would minimize the potential for cumulative impacts to occur. To address the short-term effects on sea turtles and sea turtle nesting habitat under the Proposed Action, the USAF would comply with the requirements specified in the USFWS BO provided in Appendix F. Acoustical impacts on marine mammals are also possible; however, minimal offshore areas would be affected. Thus, no significant cumulative impacts on biological resources would occur.

As for the BOA Alternative, the proposed CSM Demonstration would overlap the same general ocean area as for the two HTV-2 flight tests. The primary issue would be the potential for cumulative impacts on marine mammals and sea turtles from underwater acoustical impacts. Because the noise levels would be very short in duration, occur very few times, and would affect open ocean areas believed to have low and patchy densities of protected species, no significant cumulative impacts on biological resources would occur.

Health and Safety. Safety standards are high at USAKA/RTS and would serve to keep range safety related risks within acceptable levels for both workers and the public. The proposed CSM Demonstration activities would not occur at the same time as other flight test programs, such as the MM-III ICBM and AHW flight tests. No other projects in the ROI have been identified that would have the potential for incremental, additive cumulative impacts to health and safety. Thus, no significant cumulative impacts on health and safety are expected.

Hazardous Materials and Waste Management. Procedures used at USAKA/RTS for the Proposed Action would be identical to those conducted for ongoing activities, and the proposed flight tests at the atoll would be well within the range's capacity for operation. Also, as prior monitoring efforts have shown, air contaminant (Be and DU) levels at Illeginni Islet continue to remain at or near background levels, even

after years of ICBM reentry vehicle testing in the area. As a result, no significant cumulative impacts from hazardous materials and waste management would occur.

#### **4.4 SUMMARY OF ENVIRONMENTAL MANAGEMENT AND MONITORING ACTIONS**

Throughout this EA, various environmental management controls and monitoring systems are described. Required by Federal, state, DoD, and agency-specific environmental and safety regulations, these measures are implemented through normal operating procedures.

Although no significant or other major impacts are expected to result from implementation of the Proposed Action, some specific environmental management and monitoring actions have been identified to minimize the level of impacts that might occur at Vandenberg AFB and USAKA/RTS. These are summarized below and include the relevant sections of the EA where they are further described.

##### **Vandenberg AFB**

- 1) Construction equipment and other support equipment would be tuned and maintained to minimize engine exhaust emissions. (Section 4.1.1.1.1)
- 2) The use of emergency power portable generators for launches would require that they be permitted by the SBCAPCD or registered under the CARB Portable Equipment Registration Program. (Section 4.1.1.1.1)
- 3) A qualified biologist, familiar with seacliff buckwheat (the Federally endangered ESBB's host plant) would survey the project footprint and place flags where avoidance of individual plants is feasible during general construction activities. (Section 4.1.1.3.1)
- 4) Initial clearing of vegetation for the firebreaks would occur outside of the ESBB flight season (June 1 through September 15). (Section 4.1.1.3.1)
- 5) Vandenberg AFB would remove 1 acre (0.4 hectare) of ice plant in the vicinity of Wall Beach and plant 1,000 seacliff buckwheat seedlings during the rainy season. (Section 4.1.1.3.1)
- 6) A qualified biologist, familiar with the California red-legged frog, would survey the project area before construction work begins. If any red-legged frogs are found, they would be captured and relocated out of harm's way and within the same watershed. (Section 4.1.1.3.1)
- 7) Project activities that occur during the California red-legged frog breeding season (November through March) must occur during daylight hours, unless a Service-approved biologist is on-site to survey for the frogs during all nighttime project activities. (Section 4.1.1.3.1)
- 8) Any exposed trenches would be covered or ramped at the end of each work day to prevent wildlife from becoming trapped. (Section 4.1.1.3.1)
- 9) The Vandenberg AFB Environmental Office would provide a training session for all project workers prior to beginning work. Training would address Federally listed species and their habitats in the project area. (Section 4.1.1.3.1)

- 10) To minimize potential impacts on seal haul-outs and rookeries, and on seabirds, security helicopters or other aircraft overflights would maintain minimum slant distances from recognized seal haul-outs, rookeries, and nesting areas. (Section 4.1.1.3.2)
- 11) To minimize potential impacts on marine mammal species (pinnipeds), particularly from launch noise, the project would comply with all acoustical and biological monitoring requirements, and other measures, identified in the NMFS programmatic take permit and current LOA. (Section 4.1.1.3.2)
- 12) Prior to the launch from TP-01, USFWS-approved biologists would conduct pre-activity surveys for California red-legged frogs. If any California red-legged frogs are located in the action area, the biologist would relocate them to nearby suitable habitat out of harm's way and within the same watershed. (Section 4.1.1.3.2)
- 13) To minimize potential impacts on any nearby archaeological sites, the fiber optic cable to TP-01 would be trenched within 5 ft (1.5 m) of the road shoulder. (Section 4.1.1.4.1)
- 14) Any CSM Demonstration-related excavation work that would occur within 200 ft (61 m) of a known archaeological site would require boundary testing to ensure that portions of the site are not inadvertently disturbed. Any archaeological site or potential site where tested boundaries are within 100 ft (30 m) of the project would require monitoring by an archaeologist and/or Native American specialist during earth-disturbing activities. In the unlikely event that previously undocumented sites are discovered during the execution of the Proposed Action, work would be temporarily suspended within 100 ft (30 m) of the discovered item and the base archaeologist would be notified immediately. Work would not resume until after the site had been secured and properly evaluated. (Section 4.1.1.4.1)
- 15) The base Cultural Resources Office would brief CSM Demonstration contractors and base support personnel on the sensitivity of cultural resources, applicable Federal regulations, and the mitigation measures that might be required if archaeological or other cultural sites are inadvertently damaged or destroyed. (Section 4.1.1.4.1)
- 16) Workers would not be notified of the location of nearby archaeological sites unless the sites are to be specifically avoided by CSM Demonstration activities. (Section 4.1.1.4.1)
- 17) To avoid potential impacts to archaeological sites in the vicinity of TP-01, disk harrows would not be used for vegetation clearing and maintenance of firebreaks. (Section 4.1.1.4.1)
- 18) In the unlikely event that a flight termination or other launch anomaly were to impact land, response efforts would be coordinated with applicable range representatives and the California SHPO to develop the most appropriate mitigation measures based on the nature of the mishap and the cultural resources involved. (Section 4.1.1.4.2)
- 19) The construction contractor would apply state-approved BMPs for soil erosion control, and for the collection and disposal of waste concrete and wastewater from concrete truck washout. No concrete wastes or wastewater would be allowed to enter drainages or surface waters. (Section 4.1.1.6.1)
- 20) The construction contractor would be required to prepare a hazardous material Spill Prevention and Response Plan and obtain concurrence from the base Environmental Office. The plan would include the implementation of BMPs, such as daily inspections of construction vehicles and

equipment for fluid leaks, secondary containment provisions for equipment fueling sites, and proper handling and disposal of vehicle wastes. (Sections 4.1.1.6.1 and 4.1.1.8.1)

- 21) Whenever possible, CSM Demonstration operations at Vandenberg AFB would use environmentally-preferred and/or recyclable materials. (Section 4.1.1.8.1)
- 22) The cumulative generation of solid waste from CSM Demonstration-related facility modifications and construction activities, in addition to other planned construction and demolition projects on base, has the potential to exceed the permitted disposal tonnage on base. Coordination of implementation schedules for these projects and appropriate tracking of disposal tonnages would ensure that permitted disposal amounts at the base landfill are not exceeded. (Section 4.3.1)

## **USAKA/RTS**

- 1) As part of post-test cleanup activities on Illeginni Islet, personnel would stabilize fugitive dust and disturbed soil by wetting/washing the site with freshwater. (Sections 4.1.3.1.3 and 4.1.3.3.3)
- 2) On returning to the barges to assess the impact for the BOA alternative, personnel accessing the barges would wet or wash down the barge decks to eliminate any dust concerns prior to towing the barges back to USAKA/RTS. (Section 4.1.3.1.3)
- 3) During the flight test, personnel in the vicinity of the impact area would comply with the Army's Hearing Conservation Program. Depending on their location, personnel may be required to wear hearing protection. (Section 4.1.3.2.2)
- 4) Prior to the shipment of test support equipment and materials from the US to USAKA/RTS, the equipment would be washed and a certified Pest Control Technician or Military Veterinarian would inspect the equipment to ensure that it does not contain any insects, animals, plants, or seeds. (Section 4.1.3.3.1)
- 5) The USAF in conjunction with USAKA would inspect all project-related cargo and vehicles transiting between islets within the Kwajalein Atoll in order to prevent the further spread of rodents. Such inspections would be implemented for the duration of the CSM Demonstration flight test at USAKA/RTS. (Section 4.1.3.3.1)
- 6) During ocean travel to and from impact and test support areas, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators would also adjust their speed based on expected animal densities, and on lighting and turbidity conditions. (Section 4.1.3.3.1)
- 7) To avoid impacts on coral heads off Illeginni Islet, sensor rafts would not be located in lagoon waters less than 10 ft (3 m) deep. (Section 4.1.3.3.1)
- 8) To minimize potential impacts to migratory birds on Illeginni Islet, "scare" techniques would be implemented to discourage birds from nesting in the intended impact area. Such techniques might include use of noisemakers (e.g., propane cannons, sirens, and recorded distress calls) and visual deterrents (e.g., scarecrows, Mylar flags, helium-filled balloons, and strobe lights). The USAKA Environmental Management Office would initiate such actions several weeks prior to the beginning of equipment setup operations on the islet. To prevent birds from nesting on the support equipment after initial setup, the equipment would be appropriately covered with tarps or other materials. (Section 4.1.3.3.1)

- 9) If possible, the flight test at Illeginni would be conducted during mid-day when birds are typically at rest and less likely to be within the impact area. (Section 4.1.3.3.1)
- 10) As a precaution to preventing potential impacts on sea turtle nests, the USAKA Environmental Management Office would begin periodic inspections of the Illeginni Islet beaches for active turtle nests 30 days prior to the flight test. If nests with eggs are discovered, USAKA would immediately notify the Pacific Islands Fish and Wildlife Office and implement USFWS recommendations to avoid or minimize project-related impacts to sea turtle nests. (Section 4.1.3.3.1)
- 11) Within a few days or weeks of the test, USFWS and NMFS biologists would survey Illeginni Islet to document current conditions of sea turtle nesting areas, the conditions of other habitats, and the types and general numbers of individual species. (Section 4.1.3.3.1)
- 12) Vessel operations would not involve any intentional ocean discharges of fuel, toxic wastes, or plastics and other solid wastes that could potentially harm marine life. (Section 4.1.3.3.1)
- 13) To help prevent migratory birds from being attracted to the barges while positioned in the BOA impact area, “scare” techniques similar to those described earlier would be used on the barges. (Section 4.1.3.3.1)
- 14) As a reasonable and prudent measure to minimize the potential for sea turtle nests to be destroyed by the PDV impact, the USAF would “aim” the PDV’s terminal flight path away from known sea turtle nesting areas within the USAKA/RTS Mid-Atoll Corridor Impact Area, which includes the nesting areas at Illeginni Islet. (Section 4.1.3.3.2)
- 15) To minimize long-term risks to birds and marine life at Illeginni Islet, all visible PDV, payload particles, and other project-related debris would be recovered during post-test operations. This would include the recovery of visible debris in the shallow lagoon or ocean waters by range divers. (Section 4.1.3.3.3)
- 16) At Illeginni Islet, should any PDV or payload particle debris impact in areas of sensitive biological resources (i.e., forested areas, sea turtle nesting habitat, and coral reef), then USFWS and NMFS biologists would provide guidance and/or assistance in recovery operations to minimize impacts on such resources. In all cases, hand tools would most likely be used. (Section 4.1.3.3.3)
- 17) For the Preferred Alternative at Illeginni Islet, USAKA/RTS personnel would conduct a helicopter or fixed-wing aircraft overflight of the islet vicinity within several hours after the test to survey for any dead or injured marine mammals and sea turtles. (Section 4.1.3.3.3)
- 18) Within 1 day after the test at Illeginni Islet, USAKA/RTS, USFWS, and/or NMFS biologists would survey the islet and the near-shore waters for any injured wildlife or damage to sensitive habitats. In addition, USFWS and NMFS biologists would assist USAKA/RTS in the recovery and rehabilitation of any injured migratory birds or sea turtles found at Illeginni. During inspections of the islet, biologists would assess any sea turtle mortality. (Section 4.1.3.3.3)
- 19) The USAF would submit a report to USAKA/RTS at the end of the calendar year (in which the CSM Demonstration test occurs) that describes any sea turtle take that may have occurred at Illeginni Islet. The USAKA Environmental Management Office would then forward the report to

the Pacific Islands Fish and Wildlife Office, suggesting ways to further minimize incidental take at Illeginni Islet. (Section 4.1.3.3.3)

- 20) Prior to test implementation at Illeginni Islet, the USAF would consult with the USFWS and NMFS in the preparation of a detailed recovery/cleanup plan that outlines all post-test recovery activities and procedures for operations at the islet. In all cases, recovery and cleanup operations would be conducted in a manner to minimize further impacts on biological resources. (Sections 2.1.2.3.3 and 4.1.3.3.3)
- 21) Prior to returning the test support equipment and materials to the US, the equipment would be washed and a certified Pest Control Technician would inspect the equipment again to ensure that it does not contain any insects, animals, plants, or seeds that might have been picked up during fielding. (Section 4.1.3.3.3)
- 22) To compensate for potential impacts to sea turtle nests at Illeginni, the USAKA/RTS would implement steps to eradicate rodents on Eniwetak Islet (depending on the results of a rodent population assessment) or on Gellinam Islet. Removing rodents from one of the islets, which are located on the eastern side of Kwajalein Atoll, would help protect sea turtle nests from depredation of eggs and hatchlings. Specific steps for implementing the rodent eradication are provided in the USFWS BO (see Appendix F). (Section 4.1.3.3.3)
- 23) Although no floating debris from the PDV impact in the BOA is expected, ship personnel would recover any floating debris from the vehicle and properly dispose of it. (Section 4.1.3.3.3)
- 24) Although unlikely, any dead or injured marine mammals or sea turtles sighted during recovery operations in the BOA would be reported to the USAKA Environmental Management Office, which would then inform the NMFS in Honolulu. USAKA/RTS aircraft pilots operating in the vicinity of the impact and test support areas near Roi-Namur Islet would also report any opportunistic sightings of dead or injured mammals. (Section 4.1.3.3.3)
- 25) If the BOA Alternative were to be selected for implementation, the USAF would prepare a detailed cleanup plan that satisfies human health and safety requirements and incorporates measures to minimize ocean pollution. (Sections 4.1.3.3.3 and 4.1.3.5.3)
- 26) Prior to sinking a damaged ocean barge under the BOA Alternative, personnel would attempt to recover remaining engine fluids and batteries from any onboard hydraulic power units. Materials would be removed from the damaged barge only if it is feasible and can be conducted safely. (Sections 4.1.3.3.3 and 4.1.3.5.3)
- 27) During post-test operations for the BOA Alternative, a barge would only be scuttled after the area is determined to be clear of marine mammals and sea turtles out to a safe distance that is based on the intended explosives used to sink the barge. (Section 4.1.3.3.3)
- 28) Vessel operations, particularly in the BOA, would only occur when weather and sea conditions were acceptable for safe travel. (Section 4.1.3.4.1)
- 29) Test support personnel entering the impact site on Illeginni Islet or on the barges after the flight test would wear proper PPE, as necessary. (Section 4.1.3.4.3)

- 30) For the BOA Alternative, if personnel determine that a damaged ocean barge must be sunk in place, then only trained explosives demolition personnel would set the charge on the barge. (Section 4.1.3.4.3)
- 31) If a damaged barge must be scuttled because of navigational safety concerns, the USAKA/RTS would alert the RMI Government on the circumstances for the action. (Section 4.1.3.4.3)
- 32) Prior to recovery and cleanup actions on Illeginni Islet or on the ocean barges, UXO personnel would first survey for any residual explosive materials. If found, such materials would be collected for safe disposal. (Section 4.1.3.5.3)

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## 6.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS CONSULTED

The following agencies, organizations, and individuals were consulted or provided information during the preparation of the EA:

### **Johns Hopkins University, Applied Physics Laboratory, Laurel, MD**

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### **NOAA National Marine Fisheries Service**

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## 8.0 DISTRIBUTION LIST

The following is a list of agencies, organizations, and libraries that were sent a copy of the Draft EA/Draft FONSI for Conventional Strike Missile Demonstration.

### **Federal Agencies**

National Marine Fisheries Service, Pacific Islands Regional Office, Honolulu, HI  
National Marine Fisheries Service, Southwest Regional Office, Long Beach, CA  
National Oceanic and Atmospheric Administration, Northwestern Hawaiian Islands Marine National Monument Office, Honolulu, HI  
US Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, HI  
US Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, CA

### **State and Local Agencies**

California Coastal Commission, San Francisco, CA  
California Department of Parks and Recreation, Office of Historic Preservation, Sacramento, CA  
California Regional Water Quality Control Board, Central Coast Region, San Luis Obispo, CA  
Santa Barbara County Air Pollution Control District, Santa Barbara, CA  
Santa Barbara Museum of Natural History, Santa Barbara, CA

### **Republic of the Marshall Islands**

RMI Environmental Protection Authority

### **Native American Tribes**

Santa Ynez Band of Chumash Indians, Tribal Elders Council, Santa Ynez, CA

### **Organizations**

California Native Plant Society, San Luis Obispo, CA  
Environmental Defense Center, Santa Barbara, CA  
La Purisima Audubon Society, Lompoc, CA

### **Libraries**

Alele Museum, Library, and National Archives, Majuro, RMI  
Grace Sherwood Library, USAKA/RTS  
Lompoc Public Library (Lompoc and Vandenberg Village Branches), Lompoc, CA  
Roi-Namur Library, USAKA/RTS  
Santa Barbara Public Library, Santa Barbara, CA  
Santa Maria Public Library, Santa Maria, CA  
UC Santa Barbara Library, Santa Barbara, CA

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***APPENDIX A***  
***AGENCY CORRESPONDENCE***





REPLY TO  
ATTENTION OF  
SMDC-ENV

**DEPARTMENT OF THE ARMY**  
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND/  
ARMY FORCES STRATEGIC COMMAND  
POST OFFICE BOX 1500  
HUNTSVILLE, ALABAMA 35807-3801

14 NOV 2008

MEMORANDUM FOR Space and Missile System Center, SMC/EAF (Mr. Thomas Huynh), 483 N. Aviation Blvd, El Segundo, CA 90245-2808

SUBJECT: Cooperating Agency in the Development of an Environmental Assessment (EA) for Conventional Prompt Global Strike (CPGS)

1. In preparation for the USAF upcoming CPGS EA effort, the USASMD/ARSTRAT offers to participate as a Cooperating Agency (under National Environmental Policy Act [NEPA] regulations 40 CFR 1501.6, 1503.2, and 1508.5) in support of USAF Space and Missile System Center Acquisition Civil/Environmental Engineer Division in these specific ways:

- a. Participate in coordination meetings and teleconferences.
- b. Provide consultation on relevant technical studies that will be required for the project.
- c. Confer on appropriate agency consultations and take the lead in conducting consultations that affect USAKA/RTS and the RMI.
- d. Organize joint field reviews.
- e. Review project information and studies.
- f. Ensure the U.S. National Environmental Protection Agency compliance with requirements regarding jurisdictional approvals, permits, licenses, and clearances.

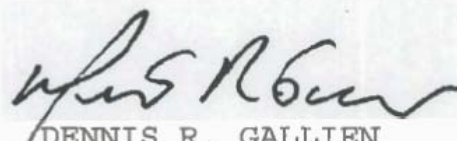
2. USAF will provide all funding necessary to support the EA effort and will ensure overall decision-making process complies with the requirements of NEPA.

14 NOV 2008

SMDC-ENV

SUBJECT: Cooperating Agency in the Development of an  
Environmental Assessment for Conventional Prompt Global Strike  
(CPGS)

3. The POCs for this action are Mr. David Hasley, (256) 955-4170, [david.hasley@us.army.mil](mailto:david.hasley@us.army.mil), and Mr. Mark Hubbs, (256) 955-2608, [mark.hubbs@smdc.army.mil](mailto:mark.hubbs@smdc.army.mil).



DENNIS R. GALLIEN

Chief, Environmental Division

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, GOVERNOR

## CALIFORNIA COASTAL COMMISSION

45 FREMONT, SUITE 2000  
SAN FRANCISCO, CA 94105-2219  
VOICE (415) 904-5200  
FAX (415) 904-5400  
TDD (415) 597-5885



December 7, 2009

Beatrice I. Kephart, YF-02  
Chief, Environmental Flight  
30<sup>th</sup> Space Wing (AFSPC)  
30 CES/CEV  
ATTN: Andrew Edwards  
1028 Iceland Avenue  
Vandenberg AFB, CA 93437-6010

Subject: Negative Determination ND-063-09 (Conventional Strike Missile Demonstration,  
Vandenberg Air Force Base, Santa Barbara Co.)

Dear Ms. Kephart:

The Coastal Commission staff has reviewed the above-referenced negative determination. The U.S. Air Force proposes to construct modifications to the existing Test Pad 01 (TP-01) at Vandenberg Air Force Base (VAFB) for a single flight test of the Conventional Strike Missile Demonstration (CSMD) program. TP-01 is located at the northern end of VAFB and has not been used for many years. As a result, various repairs, upgrades, and modifications are required in order for the site to support the CSMD program, including the addition of temporary launch structures and reestablishment of the fire break around TP-01. In June 2008, the Commission's Executive Director concurred with negative determination ND-021-08 which in part called for similar minor modifications at TP-01 for launch activities for the Kinetic Energy Interceptor program; however, this program was not implemented by the Air Force.

Reestablishing the firebreak at TP-01 would remove approximately 0.5 acre of vegetation habitat for the federally endangered El Segundo blue butterfly. The Air Force states that this adverse effect is expected to fall within the levels allowed and authorized by the upcoming U.S. Fish and Wildlife Service Biological Opinion for the proposed project. VAFB will also continue to implement the conservation measures for the blue butterfly specified in the base's Integrated Natural Resources Management Plan and will implement any new conservation measures for the blue butterfly and other federally listed species established by the upcoming Biological Opinion. In addition, the Air Force has incorporated into the proposed project all the avoidance and minimization measures used in previous projects that generated adverse effects on blue butterfly habitat, and which were supported by the U.S. Fish and Wildlife Service. The proposed project will also be conducted in accordance with the measures specified in the existing marine mammal programmatic take permit granted by the National Marine Fisheries Service.

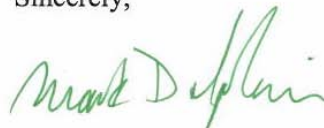


ND-063-09 (U.S. Air Force)  
Page 2

During the scheduled 2011 or 2012 CSMD test launch, Point Sal State Beach would be closed for public safety purposes. The Air Force states that the state beach is closed on average 12 times a year due to launch activities at VAFB. The one additional launch proposed under the CSMD program would not adversely affect public access and recreation along this shoreline area. The Air Force and the County of Santa Barbara continue to negotiate resolution of public access issues regarding the ability of the public to reach Point Sal State Beach through VAFB property. While the Coastal Commission has not been a party to those negotiations, the Commission staff has communicated to both the Air Force and the County that any proposal to implement changes to existing and long-standing public access to Point Sal State Beach would be subject to the Commission's federal consistency review authority.

In conclusion, the Commission staff **agrees** with the U.S. Air Force that the proposed modifications to Test Pad 01 to support the Conventional Strike Missile Demonstration program at Vandenberg Air Force Base will not adversely affect coastal resources. We therefore **concur** with your negative determination made pursuant to 15 CFR 930.35 of the NOAA implementing regulations. Please contact Larry Simon at (415) 904-5288 should you have any questions regarding this matter.

Sincerely,



(for)

PETER M. DOUGLAS  
Executive Director

cc: CCC – South Central Coast District  
California Department of Water Resources  
Governor's Washington, D.C., Office

-----Original Message-----

From: Freddie Romero [mailto:freddyromero1959@yahoo.com]

Sent: Monday, March 29, 2010 2:29 PM

To: Sam Cohen; Ryan, Christopher D Civ USAF AFSPC 30 CES/CEANC

Cc: Edwards, Andrew P Civ USAF AFSPC 30 CES/CEAOP; Carucci, James Civ USAF AFSPC 30 CES/CEANC

Subject: Re: FW: Initiation of Consultation for the Conventional Strike Missile Demonstration Project

Chris,

I have met with the Elders council and explained to them what was relayed to me at the site and my impression of impacts, and they have concurred with me. We see no impacts from this project to cultural resources and would consider sec 106 for this project concluded.

If in the future, should plans for this particular project change, the Elders Council would like to be consulted. Thank you for time and efforts in the preservation of our cultural heritage.

Freddie Romero  
Cultural Preservation Consultant  
SYBCI Elders Council  
805-688-7997 X37

## ***APPENDIX B***

### ***PROTECTED AND OTHER SPECIAL STATUS SPECIES OF THE MARSHALL ISLANDS***



**Table B-1. Protected and Other Special Status Species of the Marshall Islands**

Common Name	Scientific Name	Status
<b>Marine Mammals</b>		
Blue Whale	<i>Balaenoptera musculus</i>	E, MMPA
Finback Whale	<i>Balaenoptera physalus</i>	E, MMPA
Humpback Whale	<i>Megaptera novaengliae</i>	E, MMPA
Sperm Whale	<i>Physeter macrocephalus</i>	E, MMPA
Offshore Spotted Dolphin	<i>Stenella attenuata attenuata</i>	RS, MMPA
Coastal Spotted Dolphin	<i>Stenella attenuata graffmani</i>	RS, MMPA
Eastern Spinner Dolphin	<i>Stenella longirostris orientalis</i>	RS, MMPA
Whitebelly Spinner Dolphin	<i>Stenella longirostris longirostris</i>	RS, MMPA
Costa Rican Spinner Dolphin	<i>Stenella longirostris centroamericana</i>	RS, MMPA
Common Dolphin	<i>Delphinus delphis</i>	RS, MMPA
Striped Dolphin	<i>Stenella coeruleoalba</i>	RS, MMPA
Spinner Dolphin	<i>Stenella longirostris</i>	RS, MMPA
Pacific Bottlenose Dolphin	<i>Tursiops gilli</i>	RS, MMPA
Risso's Dolphin	<i>Grampus griseus</i>	RS, MMPA
Bottlenose Dolphin	<i>Tursiops sp.</i>	RS, MMPA
Pygmy Sperm Whale	<i>Kogia breviceps</i>	MMPA
False Killer Whale	<i>Pseudorca crassidens</i>	MMPA
Short-Finned Pilot Whale	<i>Globicephala macrorhynchus</i>	MMPA
Melon Headed Whale	<i>Peponocephala electra</i>	MMPA
Pygmy Killer Whale	<i>Feresa attenuata</i>	MMPA
Killer Whale	<i>Orcinus orca</i>	MMPA
Blainville's Beaked Whale	<i>Mesoplodon densirostris</i>	MMPA
Dugong	<i>Dugong dugon</i>	E
<b>Sea Turtles</b>		
Green Sea Turtle	<i>Chelonia mydas</i>	T, RS
Loggerhead Sea Turtle	<i>Caretta caretta</i>	T, RS
Olive Ridley Sea Turtle	<i>Lepidochelys olivacea</i>	T, RS
Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	E, RS
Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>	E, RS
<b>Birds</b>		
Ratak Micronesian Pigeon	<i>Ducula ocellata rataakensis</i>	RS
Mottled Petrel	<i>Pterodroma inexpectata</i>	MBCA
Wedge-Tailed Shearwater	<i>Puffinus pacificus</i>	MBCA
Sooty Shearwater	<i>Puffinus griseus</i>	MBCA
White-Tailed Tropicbird	<i>Phaethon lepturus</i>	MBCA
Red-Tailed Tropicbird	<i>Phaethon rubricauda</i>	MBCA
Brown Booby	<i>Sula leucogaster</i>	MBCA
Red-Footed Booby	<i>Sula sula</i>	MBCA
Great Frigatebird	<i>Fregata minor</i>	MBCA

**Table B-1. Protected and Other Special Status Species of the Marshall Islands**

Common Name	Scientific Name	Status
Pacific Reef Heron	<i>Egretta sacra</i>	MBCA
Cattle Egret	<i>Bubulcus ibis</i>	MBCA, CITES
Canada Goose	<i>Branta canadensis</i>	MBCA
Green-Winged Teal	<i>Anas crecca</i>	MBCA, CITES
Mallard	<i>Anas platyrhynchos</i>	MBCA
Northern Pintail	<i>Anas acuta</i>	MBCA, CITES
Garganey	<i>Anas querquedula</i>	MBCA, CITES
Northern Shoveler	<i>Anas clypeata</i>	MBCA, CITES
Tufted Duck	<i>Aythya fuligula</i>	MBCA
Black-Bellied Plover	<i>Pluvialis squatarola</i>	MBCA
Lesser Golden-Plover	<i>Pluvialis dominica</i>	MBCA
Mongolian Plover	<i>Charadrius mongolus</i>	MBCA
Common Ringed or	<i>Charadrius hiaticula</i>	MBCA
Semipalmated Plover	<i>Charadrius semipalmatus</i>	MBCA
Greater Yellowlegs	<i>Tringa melanoleuca</i>	MBCA
Lesser Yellowlegs	<i>Tringa flavipes</i>	MBCA
Marsh Sandpiper	<i>Tringa stagnatilis</i>	MBCA
Wood Sandpiper	<i>Tringa glareola</i>	MBCA
Wandering Tattler	<i>Heteroscelus incanus</i>	MBCA
Grey-Tailed Tattler	<i>Heteroscelus brevipes</i>	MBCA
Whimbrel	<i>Numenius phaeopus</i>	MBCA
Bristle-Thighed Curlew	<i>Numenius tahitiensis</i>	MBCA
Black-Tailed Godwit	<i>Limosa limosa</i>	MBCA
Hudsonian Godwit	<i>Limosa haemastica</i>	MBCA
Bar-Tailed Godwit	<i>Limosa lapponica</i>	MBCA
Ruddy Turnstone	<i>Arenaria interpres</i>	MBCA
Sanderling	<i>Calidris alba</i>	MBCA
Pectoral Sandpiper	<i>Calidris melanotos</i>	MBCA
Sharp-Tailed Sandpiper	<i>Calidris acuminata</i>	MBCA
Curlew Sandpiper	<i>Calidris ferruginea</i>	MBCA
Ruff	<i>Philomachus pugnax</i>	MBCA
Franklin's Gull	<i>Larus pipixcan</i>	MBCA
Black-Naped Tern	<i>Sterna sumatrana</i>	MBCA
Little Tern	<i>Sterna albifrons</i>	MBCA
Sooty Tern	<i>Sterna fuscata</i>	MBCA
Brown Noddy	<i>Anous stolidus</i>	MBCA
Black Noddy	<i>Anous minutus</i>	MBCA
White Tern	<i>Gygis alba</i>	MBCA
Great Crested Tern	<i>Sterna bergii</i>	MBCA
Fork-Tailed Swift	<i>Apus pacificus</i>	MBCA
Long-tailed Cuckoo	<i>Eudynamis taitensis</i>	MBCA
<b>Fish</b>		
Napoleon wrasse	<i>Cheilinus undulatus</i>	SOC
Giant grouper	<i>Epinephalus lanceolatus</i>	SOC
Giant coral trout	<i>Plectropomus laevis</i>	SOC



**Table B-1. Protected and Other Special Status Species of the Marshall Islands**

Common Name	Scientific Name	Status
<b>Mollusks</b>		
Top Shell Snail	<i>Trochus niloticus</i>	RS
Top Shell Snail	<i>Trochus maximus</i>	RS
Giant Clam	<i>Tridacna gigas</i>	CITES
Giant Clam	<i>Tridacna maxima</i>	CITES
Giant Clam	<i>Tridacna squamosa</i>	CITES
Giant Clam	<i>Tridacna spp.</i>	CITES
Giant Clam	<i>Hippopus hippopus</i>	CITES
Giant Finger Shell	<i>Lambis truncata</i>	CITES
Spider Conch Shell	<i>Lambis scorpius</i>	CITES
Black-Lip Mother of Pearl Oyster	<i>Pinctada margaritifera</i>	RS
<b>Sponges</b>		
All sponge species occurring within the RMI		RS
<b>Coral</b>		
Various coral species listed in Table 3-4G.1 of the UES		CITES

Notes:

E = Endangered

T = Threatened

RS = Protected under RMI Statute

MMPA = Protected under the Marine Mammal Protection Act

MBCA = Protected under the Migratory Bird Conservation Act

CITES = Protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora

SOC = Species of Concern

Source: NOAA, 2009a; USASMDC/ARSTRAT, 2009.

***APPENDIX C***

***AIR EMISSIONS METHODOLOGY  
AND CALCULATIONS***

## C.1 METHODOLOGY

All CSM Demonstration related direct and indirect emissions of criteria pollutants for site modifications, pre-launch preparations, launch, and post-launch activities at Vandenberg AFB were estimated. Detailed methodologies and emission calculations for each phase of activities are contained herein.

### C.1.1 Site Modification Equipment Emissions

Pollutant emissions resulting from activities associated with site modifications at Vandenberg AFB were estimated. Site modifications can include use of various vehicles and equipment, including portable generators, forklifts, air compressors, cranes, and trucks. Emissions from the site modification activities were estimated based on the projected activity schedule, the number of vehicles/pieces of equipment, and vehicle/equipment utilization rates (see Table C-1). Emission factors for heavy-duty diesel equipment were obtained from CARB's Off-road Mobile Source Emission Factors (CARB, 2008a). The following formula was used to calculate hourly emissions from non-road engine sources, including cranes, forklifts, and the like:

$$E = n \times EF$$

where

E = emission in pounds (lb)/day

n = hours/day of equipment operation

EF = off-road mobile source emission factor in lb/hour

Notably, emissions outlined herein represent conservative estimations of both the types of equipment to be used and the duration of construction. They can be considered the upper-bound of construction related emissions.

### C.1.2 On-road Vehicle Operations

The emissions due to site modification worker commutes, employee vehicle, and delivery/service trucks used were included in the analysis. Emission factors for motor vehicles were taken from the CARB's On-Road Emission Factors (CARB, 2008a). A sample calculation for the annual emission rate for NO<sub>x</sub> from an on-road vehicle is presented below:

Additional employees	=	50
Number of trips/day	=	2
Number of days/year	=	80
Average vehicle commute distance	=	35 miles
On-road emission factor	=	0.001 lb/mile
Annual emission level	=	50 x 2 x 80 x 35 x 0.001/2000 lb/ton
	=	0.14 ton/year

### C.1.3 Emissions from Paints, Architectural Coatings, and Adhesives

Emission factors relating emissions to total square footage (sqft) were used to estimate VOC emissions from architectural coating activities, primarily painting, and from launch vehicle assembly activities. VOC content was obtained from SBCAPCD Rules 323 (*Architectural Coatings*) and 353 (*Adhesives and Sealants*) (SBCAPCD, 1999, 2001). The following formula was used to calculate emissions from such activities:

**Table C-1. Site Modification Emissions**

Equipment Use							
Equipment Type	Units	Days	Hours/Day	Hours			
Air Compressors	1	60	4	240			
Cement & Mortar Mixers	1	60	6	360			
Cranes	1	60	7	420			
Trenchers Composite	1	30	6	180			
Bore/Drill Rigs Composite	1	30	6	180			
Tractors/Loaders/Backhoes	1	60	7	420			
Construction Equipment Emission Factors (lbs/hour)							
Equipment	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Air Compressors	0.3782	0.7980	0.1232	0.0007	0.0563	0.0563	63.6
Cement and Mortar Mixers	0.0447	0.0658	0.0113	0.0001	0.0044	0.0044	7.2
Cranes	0.6011	1.6100	0.1778	0.0014	0.0715	0.0715	128.7
Trenchers Composite	0.8237	0.1851	0.0007	0.0688	0.0688	58.7	0.5080
Bore/Drill Rigs Composite	1.3416	0.1295	0.0017	0.0591	0.0591	164.9	0.5281
Tractors/Loaders/Backhoes	0.4063	0.7746	0.1204	0.0008	0.0599	0.0599	66.8
Construction Equipment Emissions (tons)							
Equipment	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Air Compressors	0.0454	0.0958	0.0148	0.0001	0.0068	0.0068	7.6329
Cement and Mortar Mixers	0.0081	0.0118	0.0020	0.0000	0.0008	0.0008	1.3047
Cranes	0.1262	0.3381	0.0373	0.0003	0.0150	0.0150	27.0201
Trenchers Composite	0.0457	0.0741	0.0167	0.0001	0.0062	0.0062	5.2849
Bore/Drill Rigs Composite	0.0475	0.1207	0.0117	0.0002	0.0053	0.0053	14.8435
Tractors/Loaders/Backhoes	0.0853	0.1627	0.0253	0.0002	0.0126	0.0126	14.0293
Total	0.3582	0.8032	0.1078	0.0009	0.0467	0.0467	70.1
Delivery of Equipment, Supplies, and Services							
Number of Deliveries	1						
Number of Trips	2						
Miles / Trip	30						
Days of Site Modifications	30						
Total Miles	1800						
Pollutant (lb/mile)	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor (lb/mile)	0.0219	0.0237	0.0030	0.0000	0.0009	0.0007	2.7
Total Emissions (lb)	39.51	42.68	5.39	0.05	1.54	1.33	4895.0
Total Emissions (tons)	0.0198	0.0213	0.0027	0.0000	0.0008	0.0007	2.4
Number of Workers	10						
Number of Trips	2						
Miles / Trip	30						
Days of Site Modifications	30						
Total Miles	18000						
Pollutant (lb/mile)	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor (lb/mile)	0.0105	0.0011	0.0011	0.0000	0.0001	0.0001	1.1
Total Emissions (lb)	189.87	19.85	19.43	0.19	1.53	0.95	19791.6
Total Emissions (tons)	0.0949	0.0099	0.0097	0.0001	0.0008	0.0005	9.9
Site Modification Emissions Roll-Up (tons)							
Activity/Source	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Equipment Use	0.3582	0.8032	0.1078	0.0009	0.0467	0.0467	70.1
Delivery of Equipment, Supplies, and Services	0.0395	0.0427	0.0054	0.0000	0.0015	0.0013	4.9
Worker Commutes	0.1899	0.0199	0.0194	0.0002	0.0015	0.0010	19.8
<b>Total Site Modification Emissions</b>	<b>0.5876</b>	<b>0.8658</b>	<b>0.1326</b>	<b>0.0011</b>	<b>0.0497</b>	<b>0.0490</b>	<b>94.8</b>

Sources: CARB, 2008a, 2008b; SBCAPCD, 2001.

$$E = [(F \times G) / 1000] \times H$$

where

$$E = \text{emissions of VOCs from architectural coatings}$$

$$F = \text{lb of VOC emissions/gallon (gal)}$$

$$G = \text{total area to be coated in sqft}$$

$$H = \text{paint or coating coverage in sqft/gal}$$

A sample calculation for architectural coating VOC emissions during modifications of an example facility is provided below:

$$E = 0.83 \text{ [lb/gal]} \times 100,000 \text{ [sqft]} / 400 \text{ [sqft/gal]} / 2,000 \text{ [lb/ton]}$$

$$= 0.104 \text{ tons}$$

### C.1.4 Emissions from Helicopter Operations

Emission factors relating emissions to total helicopter operations on the day of the launch were estimated. Emission factors were taken from the Emissions and Dispersion Modeling System (EDMS) v. 5.0.2 (FAA, 2009). Although the exact type of aircraft to make the safety sweeps is not specified at this time, the UH-1N helicopter was used for the emission calculations. These activities and their associated emissions are extremely limited and no substantial change is expected regardless of what aircraft is used. The following formula was used to calculate emissions from the helicopters:

$$E = EF \times N$$

where

$$E = \text{Helicopter emissions}$$

$$EF = \text{Emission per operation (landing and take-off [LTO] or 90 minute flight)}$$

$$N = \text{Number of Operations}$$

A sample calculation for helicopter emissions from 20 flights is provided below:

$$E = 1.30 \text{ [lb/operation]} \times 20 \text{ [operations]} / 2000 \text{ [lb/ton]}$$

$$= 0.0130 \text{ tons of emissions}$$

### C.1.5 Emissions from the Minotaur IV Lite Booster

The Minotaur IV Lite uses the same three-stage booster as a Peacekeeper ICBM (SR-118, SR-119, and SR-120 motors). Emissions for the Minotaur IV Lite booster were developed from fuel chemistry and molar fractional analysis of the solid rocket propellant used in the Peacekeeper booster (SMC Det 12/RPD, 2005, 2006). The following formula was used to calculate emissions from the launch vehicle:

$$E = \%M \times T$$

where

$$E = \text{Booster emissions}$$

$$\%M = \text{Percentage in the products of combustion}$$

$$T = \text{Total mass of propellant}$$

A sample calculation for CO<sub>2</sub> from the launch vehicle is provided below:

$$E_{\text{CO}_2} = 2.44 \text{ [\%CO}_2\text{]} \times 16400 \text{ [lb of propellant]} / 2000 \text{ [lb/ton]}$$

$$= 0.2 \text{ tons CO}_2$$

## **C.2 EMISSION ESTIMATIONS**

### **C.2.1 Site Modifications and Pre-Launch Preparations**

All direct and indirect emissions of criteria pollutants for the site modifications and pre-launch preparations at Vandenberg AFB were estimated (Table C-2). Air emissions for these activities would include:

- Combustive emissions from equipment used for TP-01 modifications and installation of a new fiber optic cable
- Emissions from transporting components, equipment, supplies, and services to Vandenberg AFB
- Employee commuting during facility modifications and pre-launch activities
- Emissions from transporting the CSM Demonstration launch vehicle and equipment to the launch site
- Use of solvents/paints/adhesives during launch vehicle integration

### **C.2.2 Launch Activities**

In the hours before the launch, helicopters (as well as remote sensors) could be used to verify that the hazard areas are clear of non-mission-essential aircraft, vessels, and personnel. All direct and indirect emissions of criteria pollutants for the helicopter exhaust emissions and from the Minotaur IV Lite booster for one launch were estimated (Table C-3). In addition to criteria pollutants, the products of combustion from the booster would also include other common products of combustion including aluminum oxide, hydrogen chloride, hydrogen, nitrogen, carbon dioxide, and water.

### **C.2.3 Post-Launch Operations**

In the hours and days following each launch, a general safety check and cleanup of the launch site would occur. All direct and indirect emissions of criteria pollutants for worker commutes, the removal of equipment from the launch sites, and general refurbishment of launch facilities were estimated (Table C-4).

### **C.2.4 Overall Project Emissions**

A roll-up estimate of all direct and indirect emissions of criteria pollutants for the site modifications, pre-launch preparations, launch, and post-launch activities at Vandenberg AFB is provided in Table C-5.

**Table C-2. Pre-launch Emissions****Delivery of Components, Equipment, Supplies, and Services to Vandenberg AFB**

Number of Deliveries Per Day	1						
Number of Trips Per Delivery	2						
Miles / Trip	30						
Days of Assembly	90						
Total Miles	5400						
Pollutant (lb/mile)	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor (lb/mile)	0.0219	0.0237	0.0030	0.0000	0.0009	0.0007	2.7
Total Emissions (lb)	118.53	128.05	16.16	0.14	4.62	3.99	14684.9
Total Emissions (tons)	0.0593	0.0640	0.0081	0.0001	0.0023	0.0020	7.3

**Delivery of Launch Vehicle and Equipment to the Launch Site**

Number of Deliveries Per Day	1						
Number of Trips Per Delivery	2						
Miles / Trip	5						
Days of Delivery to Launch Site	2						
Total Miles	20						
Pollutant (lb/mile)	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor (lb/mile)	0.0219	0.0237	0.0030	0.0000	0.0009	0.0007	2.7
Total Emissions (lb)	0.44	0.47	0.06	0.00	0.02	0.01	54.4
Total Emissions (tons)	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	57.1

**Use of Solvents, Paints, and Adhesives During Vehicle Integration**

VOC Content	3.5	lb/gal		
Coverage	150	sqft/gal		
Emission Factor	0.07	lb/sqft		
Activities	Surface Area [sqft]	VOC [lb]	VOC [tons]	
Assembly	200	4.7	0.0023	
Total	200	4.7	0.0023	

**Crane Use at Launch Site**

Equipment Type	Units	Days	Hrs/Day	Hours			
Crane	1	10	4	40			
Pollutant	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor	0.6011	1.6100	0.1778	0.0014	0.0715	0.0715	128.7
Total Emissions (tons)	0.0120	0.0322	0.0036	0.0000	0.0014	0.0014	2.6

**Worker Commutes**

Number of Workers	20						
Number of Trips	2						
Miles / Trip	30						
Days of Pre-launch	90						
Total Miles	108000						
Pollutant (lb/mile)	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor (lb/mile)	0.0105	0.0011	0.0011	0.0000	0.0001	0.0001	1.1
Total Emissions (lb)	1139.23	119.11	116.55	1.16	9.19	5.72	118749.5
Total Emissions (tons)	0.5696	0.0596	0.0583	0.0006	0.0046	0.0029	59.4

**Pre-launch Emission Roll-Up (tons)**

Activity/Source	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Delivery of Components, Equipment, Supplies, and Services to Vandenberg AFB	0.0593	0.0640	0.0081	0.0001	0.0023	0.0020	7.3
Delivery of Launch Vehicle and Equipment to the Launch Site	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	57.1
Use of Solvents, Paints, and Adhesives During Vehicle Integration	0.0000	0.0000	0.0070	0.0000	0.0000	0.0000	0.0
Crane Use at Launch Site	0.0120	0.0322	0.0036	0.0000	0.0014	0.0014	2.6
Worker Commutes	0.5696	0.0596	0.0583	0.0006	0.0046	0.0029	59.4
<b>Total Pre-launch Emissions</b>	<b>0.6411</b>	<b>0.1560</b>	<b>0.0769</b>	<b>0.0007</b>	<b>0.0083</b>	<b>0.0063</b>	<b>126.4</b>

Sources: CARB, 2008a, 2008b; SBCAPCD, 1999.

**Table C-3. Flight Activity Emissions**

Helicopter Emissions <sup>1</sup>								
Number of Flights	2							
	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>		
LTO Emission Factors (lb/operation)	1.120	7.350	0.24	1.72	0.146	0.146		
LTO Emission (tons)	0.0011	0.0073	0.0002	0.0017	0.0001	0.0001		
Flight Emission Factors (lb/operation)	2.97	7.59	0.33	0.00	0.000	0.000		
Flight Emissions (tons)	0.00297	0.00759	0.00033	0	0	0		
Total (tons)	0.0041	0.0149	0.0006	0.0017	0.0001	0.0001		
Launch Emissions <sup>2</sup>								
Avg SR-120 Prop Mass (pound-mass [lbm])	15584							
Avg SR-119 Prop Mass (lbm)	54138							
Avg SR-118 Prop Mass (lbm)	98462							
	Molar Mass (grams)	SR-118 (%M)	SR-118 (tons)	SR-119 (%M)	SR-119 (tons)	SR-120 (lb)	SR-120 (tons)	Total (tons)
Aluminum Oxide (solid) (Al <sub>2</sub> O <sub>3</sub> )	101.96	35.89%	17.67	4.32%	9.72	5005.18	2.50	29.89
Carbon Monoxide (CO)	28.01	22.13%	10.89	23.21%	5.99	5521.32	2.76	19.65
Carbon Dioxide (CO <sub>2</sub> )	44.01	2.44%	1.20	1.05%	0.66	258.70	0.13	1.99
Hydrogen Chloride (HCl)	36.46	21.21%	10.44	15.74%	5.74	238.98	0.12	16.30
Water (H <sub>2</sub> O)	18.02	7.45%	3.67	8.30%	2.02	506.75	0.25	5.94
Hydrogen (H <sub>2</sub> )	2.02	2.23%	1.10	32.63%	0.60	349.78	0.17	1.88
Nitrogen (N <sub>2</sub> )	28.01	8.38%	4.13	7.99%	2.27	3774.91	1.89	8.28
Other Misc		0.27%	0.13	6.76%	0.07	0.00	0.00	0.21
Total		100.00%	49.23	100.00%	27.07	15655.62	7.83	84.13
Flight Activity Emissions Roll-Up (tons)								
Activity/Source	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	
Helicopter Emissions	0.0041	0.0149	0.0006	0.0017	0.0001	0.0001	0.00	
Launch Emissions	19.6458	0.0000	0.0000	0.0000	3.0783	2.1488	1.99	
Total Flight Activity Emissions	19.6499	0.0149	0.0006	0.0017	3.0785	2.1490	1.99	

**Notes:**

<sup>1</sup> CO<sub>2</sub> emission factors for helicopters are not readily available. Due to their limited use, CO<sub>2</sub> emissions from helicopters are assumed to be negligible.

<sup>2</sup> PM<sub>10</sub> and PM<sub>2.5</sub> launch emissions are assumed to be 10.3 and 7.2 percent total Al<sub>2</sub>O<sub>3</sub> respectively.

Sources: FAA 2007; SMC Det 12/RPD, 2005, 2006.



**Table C-4. Post-launch Emissions**

<b>Removal of Equipment</b>							
Number of Removals	2						
Number of Trips	2						
Miles / Trip	10						
Days of Breakdown	10						
Total Miles	400						
Pollutant (lb/mile)	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor (lb/mile)	0.0219	0.0237	0.0030	0.0000	0.0009	0.0007	2.7
Total Emissions (lb)	8.78	9.49	1.20	0.01	0.34	0.30	1087.8
Total Emissions (tons)	0.0044	0.0047	0.0006	0.0000	0.0002	0.0001	0.5
<b>Worker Commutes</b>							
Number of Workers	20						
Number of Trips	2						
Miles / Trip	30						
Days of Breakdown	10						
Total Miles	12000						
Pollutant (lb/mile)	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Emission Factor (lb/mile)	0.0105	0.0011	0.0011	0.0000	0.0001	0.0001	1.1
Total Emissions (lb)	126.58	13.23	12.95	0.13	1.02	0.64	13194.4
Total Emissions (tons)	0.0633	0.0066	0.0065	0.0001	0.0005	0.0003	6.6
<b>Painting</b>							
VOC Content	1.25	lb/gallon (gal)					
Coverage	400	sqft/gal					
Emission Factor	0.003125	lb/sqft					
Facility/Equipment	Surface Area [sqft]	VOC [lb]	VOC [tons]				
Launch Facility/Equipment	1000	3.125	0.0016				
Total	1000	3.125	0.0016				
<b>Post-launch Emissions Roll-Up (tons)</b>							
Activity/Source	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Removal of Equipment	0.0044	0.0047	0.0006	0.0000	0.0002	0.0001	0.5
Worker Commutes	0.0633	0.0066	0.0065	0.0001	0.0005	0.0003	6.6
Painting	0.0000	0.0000	0.0016	0.0000	0.0000	0.0000	0.0
<b>Total Post-launch Emissions</b>	<b>0.0677</b>	<b>0.0114</b>	<b>0.0141</b>	<b>0.0001</b>	<b>0.0007</b>	<b>0.0005</b>	<b>7.1</b>

Sources: CARB, 2008a, 2008b; SBCAPCD, 2001.

**Table C-5. Roll-Up of All Direct and Indirect Emissions Associated with the Proposed Action at Vandenberg AFB**

<b>Emissions for Entire Proposed Action (tons)</b>							
Activity/Source	CO	NO <sub>x</sub>	VOC	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Site Modifications (see Table C-1)	0.59	0.87	0.13	0.001	0.05	0.05	94.8
Pre-launch (see Table C-2)	0.64	0.16	0.08	0.001	0.01	0.01	126.4
Flight Activities (see Table C-3)	19.65	0.01	0.00	0.002	3.08	2.15	2.0
Post-launch (see Table C-4)	0.07	0.01	0.01	0.000	0.00	0.00	7.1
<b>TOTAL EMISSIONS</b>	<b>20.95</b>	<b>1.05</b>	<b>0.22</b>	<b>0.004</b>	<b>3.14</b>	<b>2.21</b>	<b>230.3</b>

### C.3 REFERENCES

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- Space and Missile Systems Center, Detachment 12/RPD (SMC Det 12/RPD). 2005. Electronic communication, data, and information. September 13 and 22.
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***APPENDIX D***

***US FISH AND WILDLIFE SERVICE***  
***BIOLOGICAL OPINION***  
***FOR***  
***ACTIVITIES AT VANDENBERG AFB, CA***



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Ventura Fish and Wildlife Office  
2493 Portola Road, Suite B  
Ventura, California 93003



IN REPLY REFER TO:  
81440-2010-F-0018

March 30, 2010

Beatrice L. Kephart  
30 CES/CEV  
1028 Iceland Avenue  
Vandenberg Air Force Base, California 93437-6010

Subject: Biological Opinion for the Modification of and Test Launch from Test Pad 01 on  
North Vandenberg Air Force Base, Santa Barbara County, California  
(8-8-10-F-2)

Dear Ms. Kephart:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the subject project on Vandenberg Air Force Base (VAFB) and its effects on the federally endangered El Segundo blue butterfly (*Euphilotes battoides allyni*) and the federally threatened California red-legged frog (*Rana aurora draytonii*). The U.S. Air Force (Air Force) proposes to modify test pad 01 (TP01) and launch one test vehicle from the site. Your request, dated October 5, 2009, was received in our office on October 7, 2009. Your request and our response are in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.).

This biological opinion was prepared using information provided in your request for formal consultation, electronic and telephone communications between our staffs, a November 17, 2009 meeting between our staffs, and information in our files. A complete administrative record of this biological opinion is available at the Ventura Fish and Wildlife Office.

#### CONSULTATION HISTORY

The biological assessment (Air Force 2009) included with your request stated that the proposed project was not likely to adversely affect the California red-legged frog, and the species was not included in your request for consultation. During telephone correspondence between our staffs, we suggested that you include the California red-legged in the formal consultation due to the close proximity of the action area to occupied and suitable California red-legged frog habitat. In a November 9, 2009, electronic mail letter, Rhys Evans of your staff concurred with this suggestion. As a result, this biological opinion will consider the subject project's effects on the California red-legged frog.





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As part of the project description, the biological assessment described the initial mowing and regular mowing maintenance of an area extending 10 feet on both sides of Rhea Road between TP01 and building 1819 (4.5 acres including the pavement of Rhea Road). The biological assessment stated that this was occupied El Segundo blue butterfly occupied habitat that contained 206 seaciff buckwheat plants (*Eriogonum parvifolium*, the host plant of the El Segundo blue butterfly). During a January 5, 2010, site visit attended by members of our staffs, it was apparent that this portion of the project area had already been mowed. Mowing a portion of the action area prior to the completion of formal consultation was an irretrievable commitment of resources with respect to available habitat for the El Segundo blue butterfly and, as such, is a violation of section 7(d) of the Act. Because this action (and potential effects to the El Segundo blue butterfly) already occurred, we will remove the mowing action from the project description and consider the effects in revised environmental baseline and status of the species sections of the biological opinion. We will retain the 10 feet on both sides of Rhea Road as part of the proposed project area, as it encompasses the proposed trenching activities between TP01 and building 1819.

The biological assessment mentioned future launches that may occur at TP01 after the test launch mentioned above. These launches are not yet scheduled and may not occur at all if the test launch is unsuccessful. Therefore, we will not address them in this biological opinion. If these future launches are to occur, they may be addressed by the pending programmatic-level consultation in progress between our office and VAFB. The Air Force may also choose to address these launches through a separate formal consultation with our office.

## BIOLOGICAL OPINION

### DESCRIPTION OF THE PROPOSED ACTION

Test pad 01 (TP01) is a pre-existing launch facility on north VAFB that has been out of use since 1991. The Air Force proposes to modify and upgrade TP01 to prepare the site for a single test launch. Proposed project activities would generally involve upgrades to communications and electrical utilities, modification of the existing concrete launch pad, installation of support structures for the test launch vehicle, and initial and ongoing mowing and maintenance of fire breaks. The proposed activities would require a variety of construction vehicles and tools including cranes, trucks, backhoes, forklifts, trenchers, air compressors, and mowers. The proposed project would begin in April 2010 and require 6 to 9 months to complete. The single test launch is currently scheduled for late 2010 or early 2011; however, the launch could take place anytime after the modifications and upgrades are completed. The location of the proposed project site on VAFB is illustrated in Figures 1 and 2 of the biological assessment (Air Force 2009) included in your consultation request, and known occurrences of federally listed species are illustrated in Figures 5, 6, and 7.

As described in the biological assessment (Air Force 2009), the proposed project activities would include:



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1. Realignment of the chain link perimeter fence around TP01;
2. Creation and regular maintenance of a firebreak by clearing all vegetation inside the chain link fence around TP01 and within a 20-foot buffer outside the fence;
3. Creation and regular maintenance of a 275-foot long by 30-foot wide (0.2 acre) firebreak by mowing south from the end of Rhea Road until the intersection with Perigee Road (see Figure 4 in the biological assessment);
4. Installation of an electrical power transformer, electrical grounding points, approximately 36 concrete mounting pads (12 by 15 inches), a 23-foot tall launch stand, and a radio antenna, on, or immediately adjacent to the existing launch pad and within the TP01 firebreak;
5. Construction of a 44-foot tall mobile scaffolding that would be erected during launch activities;
6. Maintenance/upgrade of the underground Launch Equipment Building including replacement of batteries, electronics, power lines, lighting, etc.;
7. Maintenance/upgrade/installation of communication lines, electrical lines, lighting fixtures, camera equipment, and an alert horn on existing support structures at TP01 and along Rhea Road in between TP01 and building 1819;
8. Trenching along Rhea Road to install communication lines between TP01 and building 1819. The trench would be within 5 feet of the road shoulder and would be 4900 feet long by 12 inches wide by 9 inches deep; and
9. A single test launch of a Minotaur IV Lite booster in support of the Conventional Strike Missile Program. The launch vehicle will be on the launch pad for a few seconds after ignition, and the blast radius will not exceed the boundaries of the firebreak.

As part of the project, the Air Force will implement the following measures to minimize adverse effects to the El Segundo blue butterfly and California red-legged frog:

1. A qualified biologist, familiar with the California red-legged frog, will survey the project area before construction work begins. If any California red-legged frogs are found, they will be captured and relocated outside the project area;
2. A qualified biologist, familiar with seaciff buckwheat (the host plant of the El Segundo blue butterfly) will survey the project footprint and place flags where avoidance of individual plants is feasible during general construction activities;



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3. The initial vegetation clearing will occur outside the El Segundo blue butterfly flight season which extends from June 1 through September 15;
4. Equipment will be staged on existing concrete areas;
5. Any exposed trenches will be covered or ramped at the end of each work day to prevent wildlife from becoming trapped;
6. The 30<sup>th</sup> Space Wing/Environmental Flight (30 CES/CEA) will provide a briefing for all project workers prior to beginning work. Training will address federally listed species and their habitats in the project area; and
7. The Air Force will remove 1 acre of ice plant (*Carpobrotus spp.*), in the vicinity of Wall Beach, and plant 1,000 seaciff buckwheat seedlings during the rainy season.

#### ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

The jeopardy analysis in this Biological Opinion relies on four components: (1) the *Status of the Species*, which evaluates the range-wide condition of the El Segundo blue butterfly and the California red-legged frog, the factors responsible for that condition, and the species' survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the El Segundo blue butterfly and the California red-legged frog in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the El Segundo blue butterfly and the California red-legged frog; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the El Segundo blue butterfly and the California red-legged frog; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the El Segundo blue butterfly and the California red-legged frog.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the El Segundo blue butterfly and the California red-legged frog, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the El Segundo blue butterfly and the California red-legged frog in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the El Segundo blue butterfly and the California red-legged frog and the role of the action area in the survival and recovery of the El Segundo blue butterfly and the California red-legged frog as the context for evaluation the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.



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## STATUS OF THE SPECIES

### El Segundo Blue Butterfly

The El Segundo blue butterfly was federally listed as endangered on June 1, 1976 (Service 1976). Critical habitat for the subspecies has not been designated. We issued a recovery plan for the El Segundo blue butterfly on September 28, 1998 (Service 1998). The El Segundo blue butterfly was formally described by Oakley Shields (1975) based on specimens that had been collected in the city of El Segundo, California.

The El Segundo blue butterfly is in the family Lycaenidae. It is one of five subspecies comprising the polytypic species, the square-spotted blue butterfly (*Euphilotes battoides*). These butterflies inhabit southern California, southern Nevada, Arizona, and northern Mexico. The adults have a wingspan of 0.75 to 1.25 inches. The wings of males are a brilliant blue color with an orange border on the rear of the upper hindwings. The females have dull brown colored wings with an orange border on the upper distal surface of the hindwings (Service 1998).

Like all species in the genus *Euphilotes*, the El Segundo blue butterfly spends its entire life cycle in intimate association with a species of buckwheat, in this case seacliff buckwheat. However, the nearly complete association of all life stages with a single plant is unique among North American butterflies. El Segundo blue butterfly adults mate, nectar, lay eggs, perch, and in most cases probably die on flower heads (Mattoni 1990).

The adult stage of the El Segundo blue butterfly begins in early June and concludes in early to mid-September. The onset of this stage is closely synchronized with the beginning of the flowering season for seacliff buckwheat (Mattoni 1990). Typically, adult females survive up to 2 weeks whereas a male may survive up to 7 days (G. Pratt, Department of Entomology, University of California Riverside, pers. comm. 2006a). Upon emergence as adults, females fly to seacliff buckwheat flower heads where they mate with males that are constantly moving among flower heads (Service 1998). Eggs hatch within 3 to 5 days. The larvae then undergo four instars to complete growth, a process that takes 18 to 25 days (Service 1998). By the third instar, the larvae develop honey glands, and are thereafter usually tended by ants (e.g., *Iridomyrmex humilis*, *Conomyrmex* spp.), which may protect them from parasitoids (e.g., Branchoid wasp (*Cortesia* spp.)) and small predators (Mattoni 1990). The larvae remain concealed within flower heads and initially feed on pollen, then switch to feeding on seeds sometime during the first and second instar (Pratt, pers. comm. 2006a). Larvae are highly polymorphic, varying from almost pure white or yellow to strikingly marked individuals with a dull red-to-maroon background broken by a series of yellow or white dashes (Mattoni 1990). By September, seacliff buckwheat plants have generally senesced and the larvae fall or crawl to the ground and diapause in the soil. They emerge as adults the following June. Some pupae may remain in diapause for 2 or more years (Service 1998). At least 0.5 inch of rain must penetrate the soil to accumulate enough moisture for the pupae to undergo a life stage change (Pratt, pers. comm. 2006a).



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For several decades following the subspecies' description, the El Segundo blue butterfly was presumed to be endemic to southwestern Los Angeles County in coastal southern California. Specifically, the El Segundo blue butterfly likely inhabited much of the El Segundo Dunes. Museum records reveal that the El Segundo blue butterfly was once widespread on the El Segundo sand dunes and specimens were collected at El Segundo, Redondo Beach, Manhattan Beach, and at several locations on the Palos Verdes peninsula (Donahue 1975). Known populations occur at four locations in Los Angeles County: the Ballona Wetlands, the Airport Dunes, the Chevron Preserve, and Malaga Cove. Four recovery units, based on geographic proximity, habitat similarity, and possible genetic exchange, encompass these areas with the known populations and (or) areas with restorable habitat (Service 1998).

The precise habitat requirements of El Segundo blue butterflies are not fully understood. Because El Segundo blue butterflies depend solely on seacliff buckwheat, their distribution is dependent upon the occurrence of seacliff buckwheat. The range of seacliff buckwheat is greater than the known range of the El Segundo blue butterfly; seacliff buckwheat occurs from San Diego County to the northern end of Monterey County (Pratt, pers. comm. 2006b). However, the southern extent of the El Segundo blue butterfly's known distribution is Malaga Cove in Los Angeles County; as of 2005, the northern extent of the subspecies' known distribution was the Ballona Wetlands, which is also in Los Angeles County. The El Segundo blue butterfly appears further limited to areas with high sand content (Service 1998).

In general, the El Segundo blue butterfly is negatively impacted by competition with non-native vegetation; competition, predation, and parasitism by other insects utilizing seacliff buckwheat; and habitat fragmentation. Relatively fast-growing exotics such as acacia (*Acacia* spp.), iceplant, other buckwheat species (*Eriogonum* spp.), and non-native grasses compete with seacliff buckwheat by inhibiting seedlings from sprouting and maturing to juveniles (Mattoni 1990). Pratt (1987) observed numerous insects living in seacliff buckwheat inflorescences along with El Segundo blue butterfly larvae, including lepidopterous larvae in the families of Cochylidae, Gelechiidae, Geometridae, Riodinidae, and even other Lycaenidae.

Habitat fragmentation is detrimental to small, isolated populations and produces edge effects that facilitate the introduction of invasive plant species that can out-compete and displace seacliff buckwheat. Urbanization and land conversion have fragmented the historic range of the El Segundo blue butterfly such that extant populations now operate as independent units rather than parts of a metapopulation or a single, cohesive, wide-ranging population. Small populations have higher probabilities of extinction than larger populations because their low abundance renders them susceptible to inbreeding, loss of genetic variation, high variability in age and sex ratios, demographic stochasticity, and other random, naturally occurring events such as droughts or disease epidemics (Soulé 1987). Isolated populations are more susceptible to elimination by stochastic events because the likelihood of recolonization following such events is negatively correlated with the extent of isolation (Wilcox and Murphy 1985). Given the low dispersal potential of El Segundo blue butterflies, it is unlikely that this subspecies will naturally recolonize a site.



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Recently discovered population at VAFB

The El Segundo blue butterfly was reported to occur at VAFB in 2005 by Dr. Gordon Pratt and by Dr. Pratt and Dr. Richard Arnold in 2007 (Pratt, pers. comm. 2006a; L. Bell, VAFB biologist, pers. comm. 2007). However, it is not absolutely clear whether the individuals observed at VAFB are actually the El Segundo blue butterfly or morphologically similar species. Based on wing morphology, flight period, genitalia, and host plant association, these individuals were determined to be more similar to the El Segundo blue butterfly than to any other known *Euphilotes battoides* group taxon (G. Ballmer, Department of Entomology, University of California Riverside, pers. comm. 2006; Pratt, pers. comm. 2006c). Therefore, we consider this species to be the El Segundo blue butterfly until we receive definitive information demonstrating otherwise. Given the geographic separation between VAFB and the El Segundo Dunes (approximately 120 miles) and the relatively limited dispersal capability of El Segundo blue butterflies, it is possible that the butterflies observed at VAFB are not El Segundo blue butterflies but rather an undescribed species. Butterflies in the genus *Euphilotes* can be very similar morphologically yet significantly different genetically (Mattoni 1990; Pratt 1994). Conversely, it is also possible that suitable habitat for the El Segundo blue butterfly was once contiguous from the El Segundo sand dunes to Santa Barbara County and has been displaced in some areas by development and other anthropogenic causes.

The uncertain taxonomic status of the populations that were recently discovered at VAFB makes it impossible to assess whether the current distribution of the El Segundo blue butterfly is different from the range previously stated. To conclusively determine the identity of these butterflies, VAFB has collected male individuals to compare the genetic signatures among the butterflies from VAFB with known El Segundo blue butterflies. However, clarifying the taxonomic status of these populations will not be trivial as *Euphilotes* is a diverse genus with known cryptic speciation (Mattoni 1988). Wing characters are notoriously unreliable due to individual variability, so single individuals usually cannot be confidently determined without other clues such as location, flight season, and larval host plant (Ballmer, pers. comm. 2006). During the most recent surveys conducted at VAFB, the Air Force observed 379 El Segundo blue butterflies (Air Force 2010). Arnold (1986) conducted capture-recapture studies in Los Angeles County and reported that the majority of El Segundo blue butterflies moved 100 feet or less between captures; 79 percent and 87 percent for females and males, respectively. Approximately 93 percent of females and males moved 200 feet or less, and only 3 percent of females and 4 percent of males moved more than 500 feet. The farthest distance moved by any individual butterfly was 7,200 feet (1.36 miles). Therefore, taking into account that the vast majority of individual El Segundo blue butterflies move 200 feet or less, and calculating a 200-foot buffer around each known occupied location, the Air Force determined that there is approximately 507 acres of known occupied habitat at VAFB. Over the winter of 2009/2010, 2 acres of habitat near test pad 01 was impacted due to the initial mowing of a firebreak related to the subject project, leaving approximately 505 acres of occupied habitat on VAFB.



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**California Red-legged Frog**

The California red-legged frog was federally listed as threatened on May 23, 1996 (Service 1996) and critical habitat was designated for the subspecies on April 13, 2006 (Service 2006). The Service completed a recovery plan for the subspecies in 2002 (Service 2002).

The historic range of the California red-legged frog extended coastally from southern Mendocino County and inland from the vicinity of Redding, California, southward to northwestern Baja California, Mexico (Jennings and Hayes 1985, Storer 1925). The California red-legged frog has been extirpated or nearly extirpated from 70 percent of its former range. Historically, this subspecies was found throughout the Central Valley and Sierra Nevada foothills. Four additional occurrences have been recorded in the Sierra Nevada foothills since listing, bringing the total to five extant populations, compared to approximately 26 historical records. Currently, California red-legged frogs are known from three disjunct regions in 238 streams or drainages in 31 California counties and one region in Baja California, Mexico (Grismer 2002; Fidenci 2004; and R. Smith and D. Krofta, in litt. 2005, Service 2009). California red-legged frogs have been found at elevations that range from sea level to about 5,000 feet. In the Sierra Nevada Mountains, California red-legged frogs typically occur below 4,000 feet in elevation (Service 2006).

The California red-legged frog uses a variety of habitat types, including various aquatic systems, riparian, and upland habitats. The diet of California red-legged frogs is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food item of adults. Vertebrates, such as Pacific chorus frogs (*Pseudacris regilla*) and California mice (*Peromyscus californicus*), represented over half of the prey mass eaten by larger frogs (Hayes and Tennant 1985). Feeding activity occurs along the shoreline and on the surface of the water. Hayes and Tennant (1985) found juveniles to be active diurnally and nocturnally, whereas adults were largely nocturnal.

California red-legged frogs breed from November through March; earlier breeding has been recorded in southern localities (Storer 1925). Males appear at breeding sites from 2 to 4 weeks before females (Storer 1925). Female California red-legged frogs deposit egg masses on emergent vegetation so that the masses float on the surface of the water (Hayes and Miyamoto 1984). Egg masses contain about 2,000 to 5,000 moderately-sized, dark reddish brown eggs (Storer 1925, Jennings and Hayes 1985). Eggs hatch in 6 to 14 days, and larvae undergo metamorphosis for 3.5 to 7 months after hatching (Storer 1925). Sexual maturity can be attained at 2 years of age by males and 3 years of age by females (Jennings and Hayes 1985); adults may live 8 to 10 years (Jennings et al. 1992) although the average life span is considered to be much lower. The adult California red-legged frog is a relatively large aquatic frog ranging from 1.5 to 5 inches from the tip of the snout to the vent (Stebbins 2003).

California red-legged frogs breed in aquatic habitats. Larvae, juveniles, and adults have been collected from streams, creeks, ponds, marshes, plunge pools and backwaters of streams, dune ponds, lagoons, and estuaries. California red-legged frogs frequently breed in artificial impoundments such as stock ponds, if conditions are appropriate. Although California red-



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legged frogs successfully breed in streams and riparian systems, high seasonal flows and cold temperatures in streams often make these sites risky environments for eggs and tadpoles.

The importance of riparian vegetation for this species is not well understood. When riparian vegetation is present, California red-legged frogs spend considerable time resting and feeding in it; the moisture and camouflage provided by the riparian plant community likely provide good foraging habitat and may facilitate dispersal in addition to providing pools and backwater aquatic areas for breeding.

Juvenile and adult California red-legged frogs may disperse long distances from breeding sites throughout the year. They can be encountered living within streams at distances exceeding 1.8 miles from the nearest breeding site, and have been found up to 400 feet from water in adjacent dense riparian vegetation (Bulger et al. 2003). During periods of wet weather, starting with the first rains of fall, some individuals may make overland excursions through upland habitats. Most of these overland movements occur at night. Bulger et al. (2003) found marked California red-legged frogs in Santa Cruz County making overland movements of up to 2 miles over the course of a wet season. These individual frogs were observed to make long-distance movements that are straight-line, point to point migrations over variable upland terrain rather than using riparian corridors for movement between habitats. For the California red-legged frog, suitable habitat is considered to include all aquatic and riparian areas within the range of the species and includes any landscape features that provide cover and moisture (Service 1996).

Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of the California red-legged frog in the early to mid-1900s. Continuing threats to the California red-legged frog include direct habitat loss due to stream alteration and loss of aquatic habitat, indirect effects of expanding urbanization, competition or predation from non-native species including the bullfrog, catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquitofish (*Gambusia affinis*), red swamp crayfish (*Procambarus clarkii*), and signal crayfish (*Pacifastacus leniusculus*). Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations, and is considered a threat to California red-legged frog populations.

## ENVIRONMENTAL BASELINE

The implementing regulations for section 7(a)(2) of the Act define the “action area” as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations (CFR) 402.02). For the purposes of this biological opinion and based on information provided by the Air Force, we consider the action area an approximately 8.5-acre area comprising:

1. A 0.2-acre rectangular firebreak, measuring 275 feet by 30 feet, in between the end of Rhea Road and Perigree Road;



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2. A 2.8-acre area including the TP01 concrete and asphalt pads, the fenced area around the concrete launch pad, a 20-foot buffer around the unfenced pad, and the proposed 20-foot wide firebreak around the fence;
3. A 4.5-acre area including the 4300-foot length of Rhea Road between TP01 and building 1819, and a 10-foot buffer on either side of the road; and
4. A 1-acre restoration site distinct from the TP01 portion of the action area. The site is a roughly square area near Wall Beach approximately 6 miles south-southeast of TP01, 1.75 miles northwest of the Santa Ynez River, and 1.75 miles southwest of the VAFB airfield.

Over half of the TP01 action area is made up of concrete and asphalt pads and paved road. The balance of the TP01 action area mainly contains disturbed gravel areas dating to the use of the launch pad prior to 1992, and non-native vegetation (primarily veldt grass); however, native vegetation is scattered throughout the action area. Veldt grass may exert strong competition pressure on seaciff buckwheat reproduction in the action area.

### **El Segundo Blue Butterfly**

Seaciff buckwheat can thrive in disturbed habitats, and the biological assessment reported 579 seaciff buckwheat plants in the action area (4 in the proposed fire break between Rhea Road and Perigree Road, 206 along Rhea Road, and 369 around TP01). The 10-foot areas on either side of Rhea Road were recently mowed, removing 206 (35.5 percent) of the seaciff buckwheat plants in the action area. Therefore, 373 seaciff buckwheat plants remain, and the greatest concentration of individuals is adjacent to the south side of TP01.

Biologists have reported both larval and adult El Segundo blue butterflies near TP01 (Air Force 2009), and the action area (except for the Wall Beach acre) is considered occupied habitat of the species. The Wall Beach acre is primarily covered with ice plant and contains no seaciff buckwheat. TP01 is located near the northern extent of the El Segundo blue butterfly's current known distribution. The closest known occupied site to TP01 is 750 feet to the south which is within the dispersal distances recorded by Arnold (1986).

Adult El Segundo blue butterflies may be present on seaciff buckwheat plants or on the wing throughout the action area if project activities occur during the breeding season (June 1 September 15). Eggs or larvae may be present on seaciff buckwheat flowers during the breeding season, and diapausing El Segundo blue butterflies may be present in the soil within 2 feet of any seaciff buckwheat plant in the action area between September and June.

### **California Red-Legged Frog**

Aquatic habitat for California red-legged frogs appears to be absent from the action area. California red-legged frogs have not been observed in the action area, although the action area



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and the surrounding potential habitats have not been surveyed since 1995. The biological assessment reports that surveys in 1995 documented California red-legged frogs at two sites within 0.5 mile of TP01. Figure 7 of the biological assessment (Air Force 2009) illustrates that either known occupied sites, or unoccupied but suitable habitat sites, occur within 0.5 mile of all portions of the action area except the Wall Beach area. Because of the close proximity of occupied and suitable habitat, California red-legged frogs could be present in the action area during migration or dispersal.

## EFFECTS OF THE ACTION

### El Segundo Blue Butterfly

Seacliff buckwheat plants are present within the action area and represent known occupied and potential habitat for the El Segundo blue butterfly. Two acres of occupied habitat, including at least 373 seacliff buckwheat plants, would be removed by the proposed regular mowing of the action area, leaving 503 acres of occupied habitat on VAFB. This will reduce the size of, if not eliminate, a known breeding site for the El Segundo blue butterfly near the northernmost extent of the species range. The Air Force's proposal to create suitable habitat near Wall Beach by removing one acre of ice plant and planting 1,000 seacliff buckwheat seedlings, may replace some of the lost habitat.

We assume that the El Segundo blue butterfly could occupy any seacliff buckwheat plants within the action area. The removal of, or damage to, seacliff buckwheat plants during the period when the El Segundo blue butterfly is typically active could result in the loss of all life stages of individual butterflies, because this subspecies spends its entire life cycle in very close association with its host plant.

Trenching, staged and moving vehicles, worker foot traffic, and other project activities that destroy seacliff buckwheat plants would eliminate potential breeding habitat for adult ESBB, could kill larvae developing on flowerheads, and could kill diapausing larvae. Moving vehicles could cause injury or mortality by striking adult butterflies in flight if they fly through project areas. Compacting or disturbing the soil around seacliff buckwheat plants could crush or otherwise injure diapausing El Segundo blue butterflies. The Air Force's proposals to (1) flag seacliff buckwheat plants within the action area and avoid them when feasible, and (2) attempt to create El Segundo blue butterfly and habitat by removing one acre of ice plant and planting 1,000 seacliff buckwheat seedlings, may compensate for some of the adverse effects of project activities.

Because the life span of the adult El Segundo blue butterfly is typically less than 2 weeks, precluding or disrupting normal behaviors could be detrimental to the production of the next generation of butterflies. Even brief project activities in the vicinity of seacliff buckwheat plants may cause El Segundo blue butterfly to avoid those plants, effectively eliminating a portion of available breeding habitat. The Air Force's proposal to conduct the initial vegetation removal



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after the flight season (1 June – 15 September) would allow a full breeding season to occur, and emerging butterflies would have a chance to find alternate habitat in the spring.

The Air Force proposes to conduct a test launch after modification and initial mowing activities are completed in the action area. The launch is currently unscheduled and could occur during the El Segundo blue butterfly flight season. Butterflies that emerge from diapause in an area that has been cleared of host plants will be forced to fly farther distances to find suitable food, shelter, and breeding habitat than those that emerge underneath a host plant. During this dispersal, butterflies may be exposed to greater predation rates, inclement weather, increased energy expenditure, and may not be able to find a suitable breeding location. Although unlikely, it is also possible that a butterfly could fly across TP01 during the few moments that a launch vehicle is active on the launch pad.

### **California Red-Legged Frog**

No suitable aquatic habitat for California red-legged frogs occurs in the action area, and the species has not been observed in the action area. However, several areas known to support California red-legged frogs, and several others that appear to contain suitable habitat for the species, exist within 0.5 mile of the action area. California red-legged frogs have been documented to move as far as two miles, through seemingly unsuitable habitat, and could occur in the action area while travelling between aquatic habitats. If California red-legged frogs occur in the action area they could be injured, killed, or otherwise harmed by worker foot traffic, moving vehicles, or other construction equipment. Limiting work activities to daylight hours would reduce this threat.

The Air Force proposed to have qualified biologists survey the action area prior to construction work, and, if necessary, relocate observed California red-legged frogs. The Air Force did not describe the qualifications a biologist must possess to be considered “qualified.” Survey, capture, and relocation are intended to reduce the potential for injury or mortality that may occur should California red-legged frogs remain in the action area. However, we equally anticipate that unintended injury or mortality could occur if a biologist with inadequate training and experience conducts these activities.

California red-legged frogs could become trapped in excavated trenches and holes, and could subsequently be buried or crushed when the excavation is re-filled. The Air Force’s proposal to cover or place ramps in any exposed trenches at the end of each work day would reduce this threat.

Capturing and handling California red-legged frogs to move them from a work area may result in injury or mortality as a result of improper handling, containment, transport of individuals, or from releasing them into unsuitable habitat. These effects would be reduced or prevented by the use of a Service-approved biologist.



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Capturing and relocating California red-legged frogs increases the chance of transferring diseases or pathogens (e.g., chytrid fungus) between habitats. Implementing the Declining Amphibians Populations Task Force Fieldwork Code of Practice would reduce or eliminate this threat.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. We are not aware of any non-Federal actions that are reasonably certain to occur in the action area.

## CONCLUSION

After reviewing the current status of the El Segundo blue butterfly and the California red-legged frog, the environmental baseline, the effects of the action, and the cumulative effects, it is the Service's biological opinion that the modification of TP01 and creation and maintenance of the proposed firebreaks would not jeopardize the continued existence of the El Segundo blue butterfly or California red-legged frog. We have reached this conclusion because:

1. A small proportion of El Segundo blue butterfly habitat across the species' geographic range, and no California red-legged frog aquatic habitat, would be affected by project activities;
2. The Air Force will flag and avoid seacliff buckwheat whenever feasible. The Air Force will also attempt to offset the adverse effects of the subject action and create habitat for the El Segundo blue butterfly by removing one acre of ice plant and planting 1,000 seacliff buckwheat plants;
3. The initial vegetation removal will occur outside the El Segundo blue butterfly flight season;
4. We do not expect that any adult El Segundo blue butterflies will be injured or killed during project activities; and
5. We do not expect that any California red-legged frogs will be injured or killed during project activities.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to



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engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this incidental take statement. To monitor the impact of incidental take, the Air Force must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (50 CFR 402.14(i)(3)).

We cannot determine the precise numbers of El Segundo blue butterflies or California red-legged frogs that may be taken as a result of the subject activities. Numbers and locations of individuals of these species can vary within short time frames. Because of their small body size, incidental take of adult El Segundo blue butterflies and California red-legged frogs may be difficult to detect. Injury or death of El Segundo blue butterfly larvae will be nearly impossible to detect.

The Air Force proposes to initially mow the action area between September 15 and June 1, and maintain the mowing henceforth. El Segundo blue butterflies in the action area during this time period would be in diapause. We do not anticipate that any adult butterflies would be killed or injured; however, project activities may crush or otherwise injure diapausing pupae. Additionally, adult El Segundo blue butterflies that emerge from their pupae could be adversely affected to the point of harm if they have to fly a substantial distance to other seaciff buckwheat plants to feed, breed, and shelter.

We do not anticipate that any California red-legged frogs would be killed or injured during the implementation of the proposed project because the action area does not contain California red-legged frog aquatic habitat. In addition, the Air Force will conduct pre-construction surveys for the species. We anticipate that all California red-legged frogs found within the action area would be subject to take during pre-construction surveys as qualified biologists capture and relocate any California red-legged frogs moving through the action area. We do not expect injury or mortality to occur as a result of capture and relocation of California red-legged frogs, or at least it will be very rare. As a result of capture, a subset of captured frogs may experience a substantial disruption of normal behavioral patterns to the point of harassment. However, capture and relocation is intended to reduce the potential for mortality or injury that could result from implementing the project. Any California red-legged frogs that remain in the project area may be crushed by foot-traffic or vehicles in the action area, or may be otherwise injured or killed during the proposed activities.

This incidental take statement does not exempt any activity from the prohibitions against take contained in section 9 of the Act that is not incidental to the action as described in this biological opinion. El Segundo blue butterflies and California red-legged frogs may be taken only within



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the defined boundaries of the action area as described in the Environmental Baseline section of this biological opinion.

## REASONABLE AND PRUDENT MEASURES

We believe the following reasonable and prudent measures are necessary and appropriate to minimize take of the El Segundo blue butterfly and California red-legged frog:

1. The Air Force must use biologists approved by the Service to minimize the take of El Segundo blue butterflies and California red-legged frogs.
2. The Air Force must ensure that the level of incidental take that occurs during project implementation is commensurate with the analysis contained in this biological opinion.
3. Take of California red-legged frogs during project activities must be reduced through well-defined operational procedures, and by timing work activities appropriately, with the cooperation of a Service-approved biologist.
4. The Air Force must provide the Service with a summary report(s) upon project completion.

## TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Air Force must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following term and condition implements reasonable and prudent measure 1:

The Air Force must request our approval of any biologists it wishes to employ to survey for, capture, and relocate California red-legged frogs from the work area. The Air Force must also request our approval of any additional biologists it wishes to employ to conduct monitoring activities for the El Segundo blue butterfly. The request(s) must be made to the Service at least 15 days prior to any such activities being conducted by the biologist(s), and the Air Force may only commence ground disturbance in the action area after receiving a letter of biologist approval from the Service. Please be advised that possession of a 10(a)(1)(A) permit for the covered species does not substitute for the implementation of this measure. Authorization of Service-approved biologists is valid for this project only.

2. The following terms and conditions implement reasonable and prudent measure 2:
  - a) One or more Service-approved biologist(s), or 30CES/CEA biologist(s), familiar with the El Segundo blue butterfly and the California red-legged frog, must



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conduct a training session for all project personnel prior to the onset of any ground-disturbing activities within the action area. At a minimum, this training must include a description of the El Segundo blue butterfly and California red-legged frog and their habitats, the general provisions of the Act, the necessity for adhering to the provisions of the Act, the penalties associated with violating the provisions of the Act, the specific measures that are incorporated into the description of the proposed action to avoid and (or) minimize the adverse effects to these species, and a description of the area within which project activities may occur.

- b) The Air Force must use Service-approved biologists to conduct pre-activity surveys, including prior to the test launch, for California red-legged frogs. If a juvenile or adult California red-legged frog is located in the action area, the biologist must relocate it to nearby suitable habitat out of harm's way and within the same watershed. The Service-approved biologist(s) shall be present at the work site until such time as relocation of all California red-legged frogs has been completed. After this time, the Air Force may designate a person to monitor on-site compliance with all minimization measures. The Service-approved biologist(s) shall ensure that this individual receives training outlined above in Term and Condition 2(a) and in the identification of California red-legged frogs. The monitor and the Service-approved biologist shall have the authority to halt any action that might result in impacts that exceed the levels of take anticipated by the Service during review of the proposed action. If work is stopped, the Air Force and Service shall be notified immediately by the Service-approved biologist or on-site biological monitor.
- c) If more than 2 acres of occupied El Segundo blue butterfly occupied habitat within the action area is adversely affected, or more than two California red-legged frogs or El Segundo blue butterflies are found injured or dead as a result of project activities, the Air Force must contact our office immediately so we can review the action to determine if additional protective measures are needed. The cause of death or injury must be determined by a Service-approved biologist. Project activities likely to result in take must cease during this review period.

3. The following terms and conditions implement reasonable and prudent measure 3:

- a) Project activities that occur during the breeding season, must occur during daylight hours, unless a Service-approved biologist is on-site to survey for California red-legged frogs during all nighttime project activities.
- b) In order to avoid transferring diseases or pathogens, Service-approved biologists must follow the Declining Amphibians Populations Task Force Fieldwork Code of Practice.



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4. The following term and condition implements reasonable and prudent measure 4:

The Air Force must provide a report to the Service within 90 days following completion of TP01 modification activities and a supplemental report following completion of the test launch covered by this biological opinion. Alternatively, the Air Force may choose to provide one report after completion of both modification and launch activities. The report(s) must document the number of El Segundo blue butterflies and California red-legged frogs captured, relocated, injured, or killed during the course of the project; the acreage of El Segundo blue butterfly habitat affected; a summary of the effectiveness of the terms and conditions of this biological opinion; and any suggestions of how these measures could be changed to improve conservation of these species while facilitating compliance with the Act. This document(s) will assist the Service in evaluating appropriate measures for conservation of these species during future projects.

#### DISPOSITION OF DEAD OR INJURED SPECIMENS

Upon locating a dead or injured El Segundo blue butterfly or California red-legged frog, initial notification must be made by facsimile (805) 644-3958) immediately and in writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766) within 3 working days of the finding. The report must include the date, time, and location of the carcass, a photograph, cause of death, if known, and any other pertinent information.

Care must be taken in handling injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible state for later analysis. The finder of injured specimens has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed, unless to remove it from the path of further harm or destruction. Should any listed species survive injury, the Service must be contacted regarding their final disposition.

The remains must be placed with educational or research institutions holding the appropriate State and Federal permits, such as the Santa Barbara Natural History Museum (Contact: Paul Collins, Santa Barbara Natural History Museum, Vertebrate Zoology Department, 2559 Puesta Del Sol, Santa Barbara, California 93460, (805) 682-4711, extension 321). The Air Force must make arrangements with the Museum regarding proper disposition of potential museum specimens prior to implementation of any project actions.

#### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

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We recommend that the Air Force continue conducting El Segundo blue butterfly surveys of any areas at VAFB that contain seacliff buckwheat to refine our knowledge of the subspecies' distribution.

#### REINITIATION NOTICE

This concludes formal consultation on the effects of the modification of test pad 01 at VAFB. Reinitiation of formal consultation is required if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions regarding this biological opinion, please contact David Simmons of my staff at (805) 644-1766, extension 368.

Sincerely,

/s/: Diane K. Noda

Diane K. Noda  
Field Supervisor



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***APPENDIX E***

***NATIONAL MARINE FISHERIES SERVICE  
CONSULTATION RESPONSE***



**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
**NATIONAL MARINE FISHERIES SERVICE**  
Pacific Islands Regional Office  
1601 Kapiolani Blvd., Suite 1110  
Honolulu, Hawaii 96814-4700  
(808) 944-2200 • Fax (808) 973-2941

MAR 29 2010

Mr. Vincent R. Caponpon  
Acting Chief, Acq. Civil & Environmental Engineering  
Department of the Air Force SMC/EAF  
483 North Aviation Blvd.  
El Segundo, CA 90245-2808

Dear Mr. Caponpon:

This letter responds to your June 24, 2009 letter regarding the proposal by the US Air Force (USAF) Space and Missile Systems Center (SMC) to conduct a single Demonstration Flight of the Conventional Strike Missile (CSM) from Vandenberg Air Force Base (AFB), California to the US Army Kwajalein Atoll (USAKA) Ronald Regan Ballistic Missile Defense Test Site (RTS) in the Republic of the Marshall Islands (RMI). In that letter, you made the dual determination that: 1) Activities over international waters and within the Broad Ocean Area (BOA) of the Marshall Islands "... 'may affect but is not likely to adversely affect' the ESA listed marine mammals identified in Table 3-8 and Appendix B in the CSM CDEA." and 2) Activities within the jurisdiction of the RMI "may affect" those same marine mammal species. You also requested our concurrence under section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 *et seq.*) for potential impacts on marine resources in international waters and within the BOA, and under the Environmental Standards and Procedures for United States Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands, (aka USAKA Environmental Standards or UES) for activities within the jurisdiction of the RMI. You updated your consultation request on October 23, 2009, and included the determination under the UES that debris impacts resulting from the CSM Demonstration at Illeginni Islet "may affect" green and hawksbill sea turtles, along with three marine mollusk species protected by the government of the RMI and USAKA; *Trochus maximus* and *T. niloticus*, and *Pinctada margaritifera*.

**Geopolitical Background for Actions in the RMI:** The relationship between the United States (US) Government and the Government of the RMI is governed by the Compact of Free Association (Compact), as Amended in 2003 (48 USC 1921). The Compact obligates the US to apply the National Environmental Policy Act of 1969 (NEPA) to its actions in the RMI as if the RMI were a part of the US. Additionally, the Compact specifically requires the US government to develop and apply environmental standards that are comparable to several other US environmental laws, including the ESA. The standards and procedures described in the UES are intended to satisfy that requirement. As such, the US Government must apply the UES to its activities controlled by USAKA and in the Mid-Atoll Corridor and for USAKA/RTS activities in the RMI. Because the proposed action includes potential impacts on protected marine species in international waters and the BOA (where the ESA applies) as well as within the RMI (where the UES applies instead of the ESA), this letter is written with language intended to satisfy the action





agency's need to meet the requirements of the both the ESA and the UES, and includes the non-ESA-listed mollusks specified above.

Proposed Action/Action Area: The proposed action is described in detail in your Coordinating Draft Environmental Assessment (CDEA) for CSM Demonstration (USAF 2009a). In summary, the proposed action is to conduct a single test flight of the CSM sometime during calendar years 2011 or 2012. The missile would be launched from Vandenberg AFB, California, carrying a Payload Delivery Vehicle (PDV) that would glide over the Pacific Ocean and impact on Illeginni Islet, Kwajalein Atoll, RMI. The demonstration is best described in three area-based phases:

1. **Launch:** A Minotaur IV Lite, 3-booster launch vehicle would be launched from Vandenberg carrying an armed PDV. The launch vehicle and PDV would enter the Over-Ocean Flight phase, within seconds after the launch.
2. **Over-Ocean Flight:** The launch vehicle would arc west over the ocean, generating a single sonic boom about 83 km (45 nautical miles) off the California coast. The solid propellant boosters would fire and fall away from the vehicle in sequence. Spent booster motors, the guidance stage, and various fairings and adapters from the launch vehicle would impact in the open ocean along the flight path west of California and well east of the Northwest Hawaiian Islands (NWHI) (Figure 1). Near the missile's apogee, the PDV will separate and enter a hypersonic glide through the upper atmosphere, passing over the NWHI in route to the RMI. The PDV would generate a traveling sonic boom (carpet boom) as it travels over the ocean (USAF 2009a).
3. **Terminal Flight and Impact in the RMI:** Approximately 60 days prior to launch, the USAF would set up a target on Illeginni Islet to determine the effects of the weapon. A landing craft (LCU) would transport supplies using a pre-existing ramp on Illeginni. About 15 personnel would be transported on and off Illeginni by helicopter to set-up the target. Within a few days of launch, three sensor-carrying rafts would be moored around Illeginni to collect data.

At the terminal end of the flight, the PDV would enter a near-vertical dive and impact on Illeginni Islet. The PDV would detonate a high explosive warhead close to the surface, discharging thousands of bullet-sized metal particles in a downward-focused blast, with the debris of the PDV also impacting the target area (USAF 2009a). Personnel would return to Illeginni to assess the weapon's effectiveness. All detectable particles and debris would be collected, the target and sensor rafts would be dismantled and removed, and the impact crater would be filled (USAF 2009a).

The action area for this consultation begins at the Vandenberg launch site and extends in an arc across the Pacific Ocean, terminating at Illeginni Islet (Figure 1). The action area includes the shoreline adjacent to the Vandenberg launch site, the narrow band of ocean area directly under the flight path, and Illeginni Islet in the RMI. The action area also includes the area immediately around support vessels and aircraft used in conjunction with this demonstration flight.



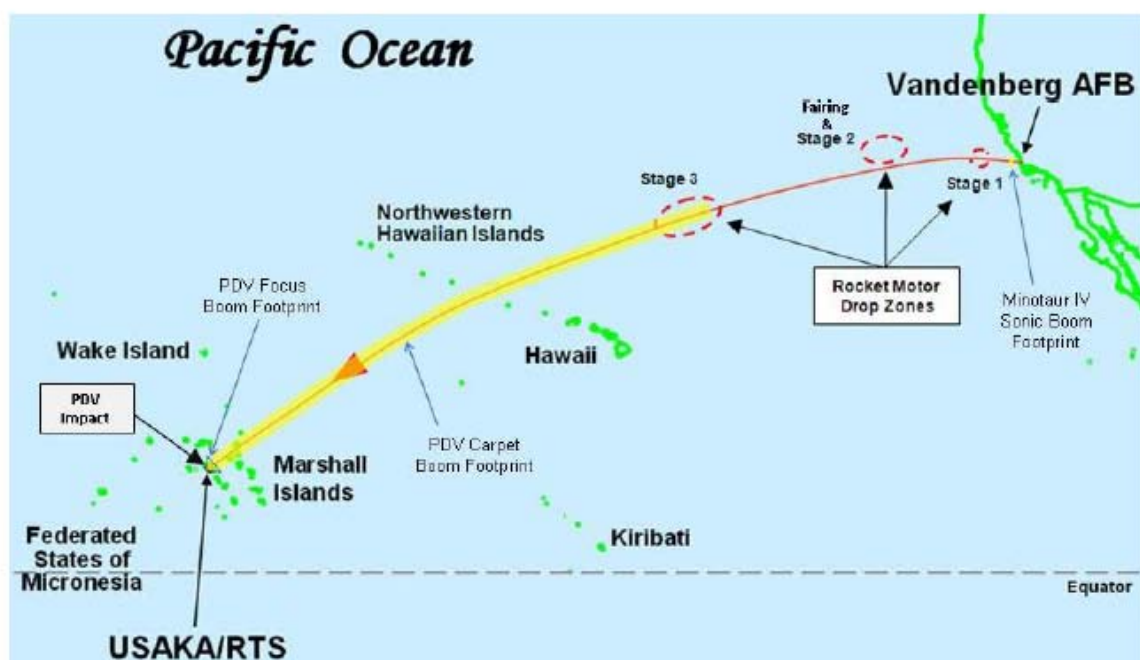


Figure 1. Action area for the CSM Demonstration Project, showing the missile's flight path and impact zones.

#### Species That May Be Affected:

Table 1. ESA-listed species under NMFS jurisdiction that occur in marine waters between the coast of California and the Marshall Islands Archipelago.

Species	Scientific Name	ESA Status	Listed	Federal Register
Blue Whale	<i>Balaenoptera musculus</i>	Endangered	12/02/1970	35 FR 18319
Fin Whale	<i>Balaenoptera physalus</i>	Endangered	12/02/1970	35 FR 18319
Humpback Whale	<i>Megaptera novaeangliae</i>	Endangered	12/02/1970	35 FR 18319
N. Pacific Right Whale	<i>Eubalaena japonica</i>	Endangered	12/27/2006	71 FR 77694
Sei Whale	<i>Balaenoptera borealis</i>	Endangered	12/02/1970	35 FR 18319
Sperm Whale	<i>Physeter macrocephalus</i>	Endangered	12/02/1970	35 FR 18319
Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	Endangered	06/02/1970	35 FR 8491
Guadalupe Fur Seal	<i>Arctocephalus townsendi</i>	Threatened	12/16/1985	50 FR 51251
Hawaiian Monk Seal	<i>Monachus schauinslandi</i>	Endangered	11/23/1976	41 FR 51612
Steller Sea Lion - Eastern Distinct Population Segment	<i>Eumetopias jubatus</i>	Threatened	11/26/1990	55 FR 49204
Green Sea Turtle	<i>Chelonia mydas</i>			
Nesting aggregations in Florida and on west coast of Mexico		Endangered	07/28/1978	43 FR 32800
All other Green Sea Turtles		Threatened	07/28/1978	43 FR 32800
Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>	Endangered	07/28/1978	43 FR 32800
Loggerhead Sea Turtle	<i>Caretta caretta</i>	Threatened	07/28/1978	43 FR 32800
Olive Ridley Sea Turtle	<i>Lepidochelys olivacea</i>			
Nesting aggregations on west coast of Mexico		Endangered	07/28/1978	43 FR 32800
All other Olive Ridley Sea Turtles		Threatened	07/28/1978	43 FR 32800

Blue whale biology, habitat, and conservation status is described in the recovery plan (NMFS 1998). Blue whales occur regularly off the coast of California. They have been seen near the



Hawaiian Islands on rare occasions, and have been acoustically recorded near Wake Island. Although unlikely, they may occur in the RMI in low numbers. Globally, blue whales were depleted by commercial whaling, which ended for this species in the Pacific in 1966. However, they are still hunted by some countries under subsistence and scientific whaling programs. Although numbers have likely increased since the moratorium against commercial whaling, information is limited for global and regional distributions and density.

Fin whale biology, habitat, and conservation status is described in the draft recovery plan (NMFS 2006a). They are pelagic, and generally occupy coastal and shelf waters throughout the temperate to polar oceans of the world, but can also be found in deep open ocean waters. Fin whales are occasionally sighted near Hawaii. Although unlikely, they may occur in the RMI in low numbers. Globally, fin whales were depleted by commercial whaling, which ended for this species in the Pacific in 1977. However, they are still hunted by some countries under subsistence and/or scientific whaling programs. Although numbers have likely increased since the moratorium against commercial whaling, information is limited for global and regional distributions and density.

Humpback whale biology, habitat, and conservation status is described in the draft recovery plan (NMFS 1991). Humpbacks winter-over in large numbers near the Hawaiian Islands. They also winter-over in the Marianas and off the California coast. Humpbacks may occasionally occur around the islands of the RMI. Globally, humpback whales were depleted by commercial whaling, which ended for this species in the North Pacific in 1965. However, they are still hunted by some countries under subsistence and/or scientific whaling programs. Numbers have increased for some stocks since the moratorium against commercial whaling, particularly for those in the east and central North Pacific.

North Pacific right whale biology, habitat, and conservation status is described in the most recent status review (NMFS 2006b) and in the recovery plan (NMFS 2005). They were previously listed as endangered together with North Atlantic right whale as Northern right whales. They have been very rare in the eastern and central North Pacific since the seventies, and are not thought to occur in the RMI. Northern right whales were severely depleted by commercial whaling until the International Whaling Commission (IWC) banned all harvest of them in 1949. However, their numbers remain dangerously low. Information is limited for global and regional distributions and density, but they are the rarest of all large whale species. The current North Pacific right whale population is likely below 1,000 animals.

Sei whale biology, habitat, and conservation status is described in Leatherwood et al. (1988), Reeves et al. (2002), and in several website articles (American Cetacean Society 2008 and Shefferly 1999). Although they are known to occur around Guam, Hawaii, and off the west coast of Mexico, they are unlikely to occur in the RMI. Globally, sei whales were depleted by commercial whaling, which ended for this species in the North Pacific in 1975. However, they are still hunted by some countries under subsistence and/or scientific whaling programs. Although numbers have likely increased since the moratorium against commercial whaling, information is limited for global and regional distributions and density.



Sperm whale biology, habitat, and conservation status is described in the draft recovery plan (NMFS 2006c). They are regularly sighted in the waters around the Hawaiian and Mariana Islands, and are also known to occur in the waters around Kwajalein. Globally, sperm whales were depleted by commercial whaling, which ended for this species in the Pacific in 1986. However, they are still hunted by some countries under subsistence and/or scientific whaling programs. Although numbers have likely increased since the moratorium against commercial whaling, information is limited for global and regional distributions and density.

Guadalupe fur seal biology, habitat, and conservation status is described in the 2000 Stock Assessment Report (SAR) for this species (NMFS 2000) and the Obis SEAMAP website (<http://seamap.env.duke.edu/species/tsn/180636>). Guadalupe fur seals breed on Isla de Guadalupe and Isla Benito del Este off the coast of Baja California, Mexico, but are sighted as far north as Point Reyes, California. They were thought extinct by 1894, due to commercial sealing. The size of the population prior to commercial harvests is not known, but estimates range from 20,000 to 100,000 animals. The population of Guadalupe fur seals has been increasing at an average annual growth rate of 13.7 percent, and the population was estimated to be about 7,408 animals in 1993 (NMFS 2000).

Hawaiian monk seal biology, habitat, and conservation status is described in the NMFS 12-month finding for revision of monk seal critical habitat (74 FR 27988) and in the recovery plan (NMFS 2007). Hawaiian monk seals are endemic to the Hawaiian Archipelago, with the majority of the population spread among the NWHI. They are critically endangered, numbering approximately 1,200 animals, and decreasing by about 4% annually (NMFS 2007). However, monk seal pupping is increasing within the MHI.

Steller sea lion biology, habitat, and conservation status is described in their recovery plan (NMFS 2008). Steller sea lions range from the Channel Islands off Southern California to Northern Hokkaido, Japan, with population centers in the Gulf of Alaska and the Aleutian Islands. Decline likely began in the late 1950s and continued into the 1990s, largely due to direct and indirect impacts from commercial fisheries. The over-all decline is estimated at about 80% (NMFS 2008). The Eastern DPS abundance was estimated, in 2002, at 46,000 to 58,000 animals, with abundance is increasing about 3% annually (NMFS 2008).

Green sea turtle biology, habitat, and conservation status is described in their recovery plan and in a recent status review (NMFS & USFWS 1998a & 2007a). Greens are numerous around Hawaii and are known to occur and nest in low numbers in the Marshall Islands. Globally, most of the important green sea turtle nesting populations declined substantially during the 20<sup>th</sup> century. Although conservation efforts over the past 25 years or more appear to have had some positive results (Chaloupka et. al. 2008), threats and impacts persist for a number of Pacific sea turtle populations.

Hawksbill sea turtle biology, habitat, and conservation status is described in their recovery plan and in a recent status review (NMFS & USFWS 1998b & 2007b). Hawksbills occur in low numbers around nearly all tropical to sub-tropical island groups in the Pacific Ocean (NMFS &



USFWS 1998b). Hawksbills are less common than greens, but are known to occur and nest in low numbers in Hawaii and the RMI. Globally, hawksbill nesting populations have declined substantially during the 20<sup>th</sup> century, and declines appear to continue (NMFS & USFWS 2007b).

Leatherback sea turtle biology, habitat, and conservation status is described in their recovery plan and in a recent status review (NMFS & USFWS 1998c & 2007c). Leatherbacks occur in low numbers in tropical to sub-polar pelagic waters throughout the Pacific Ocean basin (NMFS & USFWS 1998c), and are expected to occur across the entire action area. They are critically endangered. Globally, leatherback nesting populations have declined substantially during the 20<sup>th</sup> century, and declines appear to continue (NMFS & USFWS 2007c).

Loggerhead sea turtle biology, habitat, and conservation status is described in their recovery plan and in a recent status review (NMFS & USFWS 1998d & 2007d). Loggerheads occur in low numbers in the pelagic waters North and Northeast of Hawaii. It is unlikely that they occur in the RMI. Globally, loggerhead nesting populations have declined substantially during the 20<sup>th</sup> century, and declines appear to continue (NMFS & USFWS 2007d).

Olive ridley sea turtle biology, habitat, and conservation status is described in their recovery plan and in a recent status review (NMFS & USFWS 1998e & 2007e). Olive ridleys occur in the pelagic waters south and southwest of Hawaii, and are expected to occur in the RMI. Globally, olive ridley nesting populations declined substantially during the 20<sup>th</sup> century, but nesting appears to be increasing in some areas, and olive ridleys are now considered the most common sea turtle species (NMFS & USFWS 2007e).

With the exception of fin, North Pacific right, and sei whales; Guadalupe fur and Hawaiian monk seals; as well as steller sea lions, the species listed above are covered under the UES as well as the ESA. Although not covered by the ESA, the species listed in Table 2 are protected by RMI statutes. Because this consultation must satisfy the needs of the UES as well as the ESA, it will also consider potential impacts on these marine species in addition to the ESA-listed species above.

**Table 2. Non-ESA-listed Marine species protected under RMI statutes that can trigger consultation procedures.**

Species	Scientific Name	RMI Statute
<b>Species unlikely to be affected by the proposed action.</b>		
Common Dolphin	<i>Delphinus delphis</i>	Marine Mammal Protection Act 1990, 33 MIRC
Spinner Dolphin, Costa Rican	<i>Stenella longirostris centroamericana</i>	Marine Mammal Protection Act 1990, 33 MIRC
Spinner Dolphin, Eastern	<i>Stenella longirostris orientalis</i>	Marine Mammal Protection Act 1990, 33 MIRC
Spinner Dolphin, Whitebelly	<i>Stenella longirostris longirostris</i>	Marine Mammal Protection Act 1990, 33 MIRC
Spotted Dolphin, Coastal	<i>Stenella attenuata graffmani</i>	Marine Mammal Protection Act 1990, 33 MIRC
Spotted Dolphin, Offshore	<i>Stenella attenuata attenuata</i>	Marine Mammal Protection Act 1990, 33 MIRC
Striped Dolphin	<i>Stenella coeruleoalba</i>	Marine Mammal Protection Act 1990, 33 MIRC
Any other species of small-toothed cetaceans		Marine Mammal Protection Act 1990, 33 MIRC
Black-Lip Mother-of-Pearl Oyster	<i>Pinctada margaritifera</i>	Marine Resources Act, 33 MIRC
Commercial Top Shell	<i>Trochus maximus</i>	Marine Resources (Trochus) Act 1983, 33 MIRC
Commercial Top Shell	<i>Trochus niloticus</i>	Marine Resources (Trochus) Act 1983, 33 MIRC



The CDEA stated that marine mammals have not been observed in the nearshore waters around Illeginni Islet, the closest reported sightings being sperm and pilot whales “a few miles southeast of Illeginni” (page 57). The analysis in the CDEA (pages 58, 59, 85, 88, 89, 91, 92, 94-96, and 99-101) also determined that the potential stressors of the Terminal Flight and Impact in the RMI phase of the demonstration would have “negligible effect” or “no significant impacts” on protected marine mammals. Based on the rationale detailed in the CDEA, and the expected absence of marine mammals in nearshore waters around Illeginni, NMFS concurs that the Terminal Flight and Impact in the RMI is not likely to adversely affect marine mammals, so UES-protected marine mammals will be discussed no further in this consultation.

**Top Shell Snails (*Trochus maximus* and *T. niloticus*):** Also known as the commercial top shell, *T. maximus* and *T. niloticus* are likely the same species with *T. maximus* being an archaic and seldom used name for a variant of *T. niloticus* (Tryon and Pilsbry 1889). Based on the dearth of support for *T. maximus* found during the literature search, both species will herein be referred to together as “commercial top shells”. Commercial top shells are indigenous to Yap, Palau, and Helen Reef in Micronesia, but they have been introduced to nearly every island group across the Indo-Pacific region (Smith 1987) because they are an edible species whose shells are also commercially important in the mother of pearl button industry (Heslinga et al. 1984). Larvae recruit to shallow intertidal zones, typically along exposed (seaward) shores. Individuals migrate into deeper water as they grow (Heslinga et al. 1984) with maximum reported depth being 24 m (Smith 1987). Unregulated or poorly regulated harvesting has led to their depletion across their range. Recent surveys confirm their presence around Illeginni Islet, but give no distribution information (USFWS 2009).

**The Black-lip Mother of Pearl Oyster (aka black-lip oyster, *Pinctada margaritifera*):** The majority of available research on this species is heavily focused on their commercial cultivation. Very little information was found to describe their distribution or preferred habitats in the wild other than mentioning that they are predominantly found on hard substrates within lagoons and other protected waters. Observations while diving in numerous locals across the Pacific confirm this, and suggest they are typically subtidal; inhabiting depths of about 1 m to over 30 m, with the highest densities between 5 and 15 m (D. Hubner pers. Comm.). Until relatively recently, black-lip oysters were commercially harvested by divers, and they have become depleted across their range due to over-exploitation. Recent surveys confirm their presence around Illeginni Islet, but give no distribution information (USFWS 2009).

**Critical Habitat:** Critical habitat was designated under the ESA for the Hawaiian monk seal on May 26, 1988. It is the only designated critical habitat under NMFS jurisdiction within the action area. It extends from shore to a depth of 20 fathoms in ten areas of the NWHI. No critical habitat has been designated or proposed for designation for any ESA-listed marine species in the RMI.

**Analysis of Effects:** In order to concur that a proposed action is not likely to adversely affect listed species, under the ESA, NMFS must find that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint USFWS-NMFS



Endangered Species Consultation Handbook: (1) insignificant effects relate to the size of the impact and should never reach the scale where take occurs; (2) discountable effects are those that are extremely unlikely to occur; and (3) beneficial effects are positive effects without any adverse effects (USFWS & NMFS 1998). This standard, as well as consideration of the probable duration, frequency, and severity of potential interactions between the marine listed species and the proposed action, were applied during the analysis of effects of the proposed action on ESA-listed, as well as UES-protected, marine species and is described below.

NMFS considered the potential stressors of the proposed action, as described in the CDEA, taking into account the biological and/or ecological information for the fourteen ESA-listed species and the 3 UES-protected mollusks listed above. NMFS considered the potential stressors and impacts on these species, according to three distinct area-based phases: (1) Launch; (2) Over-Ocean Flight; and (3) Terminal Flight and Impact in the RMI. The potential stressors and impacts most likely to result from the proposed action follow according to the three area-based phases.

1. Launch: No ESA-listed marine species or designated critical habitat under NMFS jurisdiction are in the areas adjacent to the launch facilities. Thus, the pre-launch and launch activities will have no effect on those resources, and no further effects analysis is required for this phase.

2. Over-Ocean Flight: The potential stressors from missile flight and missile component impacts on the water's surface are:

- a. Exposure to elevated noise levels;
- b. Impact of falling missile components; and
- c. Exposure to hazardous materials.

3. Terminal Flight and Impact in the RMI: The potential stressors from PDV over-flight across the RMI and impact on Illeginni Islet are:

- a. Exposure to elevated noise levels;
- b. Impact of falling missile components;
- c. Exposure to hazardous materials;
- d. Disturbance from human activity and equipment operation; and
- e. Collision with vessels.

a. Exposure to elevated noise levels: Over-Ocean Flight (sonic booms and falling missile component impact noise): The analysis in the CDEA (pages 81 and 82) stated that marine animal density is expected to be low and patchy in distribution below the flight path, the in-water foot print of adversely high sound pressure level (SPL) is small for both sources, sonic events are very short in duration, and the number of component impacts is low. Based on that, the USAF determined that exposure to adverse sound levels from these stressors is discountable, and NMFS concurs.



The PDV's flight path crosses designated critical habitat in the NWHI. However, the nearest booster section impact will occur nearly 1,800 km (1,000 nmi) away to the northeast (CDEA Figure 2-4, page 14). The PDV's brief in-air sonic boom of 114 dB, (140 dB re 1  $\mu$ Pa in water) in the NWHI is the only expected impact in the NWHI. NMFS has determined that this will have insignificant effects on designated critical habitat.

**Terminal Flight and Impact in the RMI (sonic booms and PDV detonation noise):** The analysis in the CDEA (pages 88, 91 and 92) stated that for the same reasons as directly above, the carpet and focused sonic booms will have negligible effects on sea turtles, whereas the PDV detonation was determined to have no adverse effect on sea turtles as well as the 3 mollusk species listed in Table 2. The CDEA based these determinations on the belief that the focused boom's highest SPL would be confined to the land, and that the in-water SPLs from the PDV detonation would not exceed the adverse impact thresholds based on US Navy documents. NMFS agrees that the impacts of these stressors will be insignificant, and as such are not likely to adversely affect sea turtles, or mollusks around Illeginni. However, we do so primarily based on Laney and Cavanagh (2000), who report that sound waves arriving at the air/water interface at an angle less steep than 13.3° from of the vertical will decay exponentially with distance and as such will not normally propagate in water. Based on the expected angle of decent and the planned low altitude detonation, we expect that adverse SPLs will be confined almost exclusively to the land, and that the affected waters will be too shallow to support the protected species concerned.

**b. Impact of falling missile components: Over-Ocean Flight (three booster sections and eight components that make up the inter-stage, the guidance and control assembly, and various adapters and fairings):** The analysis in the CDEA (pages 81 - 83) stated that marine animal density is expected to be low and patchy in distribution below the flight path, the in-water footprint of adverse effects from impact is small, and the number of component impacts is low. Based on that, the USAF determined that the splashdown of missile components is not expected to have a significant impact on marine mammals and sea turtles in the open ocean. NMFS agrees that this stressor is not likely to adversely affect protected marine resources, but does so because we consider the likelihood of this interaction to be discountable.

**Terminal Flight and Impact in the RMI (PDV warhead projectiles and debris impacting Illeginni):** The analysis in the CDEA (pages 94 - 96) and the Overview presentation (USAF 2009a, page 14) indicate that over 99% of the warhead projectiles and PDV debris is expected to impact on the island, out of the marine environment. The CDEA also stated that few turtles have been sighted around the islet during past surveys, and that limited numbers of the protected mollusks occur in the shallow waters around the islet. Based on this, the USAF determined that this stressor will have insignificant impacts on protected marine resources. NMFS agrees that this stressor is not likely to adversely affect on protected marine resources, but does so because we consider the likelihood of this interaction to be discountable.

**c. Exposure to hazardous materials: Over-Ocean Flight (Splashdown of missile components):** The analysis in the CDEA (pages 69, 70, 83, and 84) stated that unburned solid propellant entering the ocean due to a launch failure is highly unlikely, but would leach very slowly into sea water, likely in deep water away from protected species, and it is likely to quickly dilute due to currents, thus never accumulating to toxic levels. The inside of spent rocket motor casings will



contain only a residual coating of aluminum oxide and burnt hydrocarbons. The amount of other toxic substances, such as battery acid, hydraulic fluids, and heavy metals is small. The affected areas will be very small, and the material will quickly sink to the bottom in deep waters; well away from protected marine species. Based on this, along with the expectation that marine animal density is low and patchy in distribution below the flight path, the USAF determined that this stressor will have insignificant impacts on protected marine resources. NMFS concurs.

**Terminal Flight and Impact in the RMI (PDV detonation and impact):** The analysis in the CDEA (pages 85, 95, and 100) stated that the PDV detonation and impact will aerosolize a small amount of toxic material, and that the impact may mobilize a small amount of toxic residue that may exist in Illeginni's soils. However, the prevailing winds are expected to quickly disperse this small quantity of airborne toxic material across a large area of the ocean, keeping concentrations below toxic levels, and the waves and currents will further disperse and dilute the material. Based on this information, the USAF determined that this stressor will have insignificant impacts on protected marine resources. Based on this and the USAF's plan to search for and remove PVD and warhead debris from Illeginni and the surrounding waters, NMFS concurs. **Vessel and heavy equipment operations (toxic spills, discharges, and wastes):** The analysis in the CDEA (pages 58, 59, and 99-101) states that comprehensive procedures are in place to control, contain, and clean hazardous materials. Based on this, the USAF determined that this stressor will have insignificant effects on protected marine resources. NMFS concurs.

**d. Disturbance from human activities and equipment operation:** **Terminal Flight and Impact in the RMI:** The USAF did not specifically address this as a stressor in the CDEA. However, based on the description of the proposed action, many of the activities done to complete the demonstration are expected to take place in close proximity to known habitats for protected marine species covered by this consultation. Thus those animals, with the exception of the mollusk species, may be disturbed by these activities should they encounter them. However, few sea turtles are expected around Illeginni, and turtles that are encountered will likely avoid human activities on their own. Based on this, the most likely effect expected due to this stressor will be an infrequent and insignificant level of behavioral modification through temporary areal avoidance leading to exposed turtles leaving the area without injury. Based on the above, NMFS has determined that this stressor will have insignificant effects on protected marine resources.

**e. Collision with vessels:** **Terminal Flight and Impact in the RMI (LCU transits, positioning telemetry rafts):** The CDEA did not specifically address this as an individual stressor. However, the CDEA (page 89) stated that personnel would watch for and avoid marine mammals and sea turtles, including adjusting their speed based on animal density and visibility conditions to avoid ship strikes. Based on the expected low density of sea turtles and marine mammals in and around Kwajalein Atoll (including Illeginni), the limited number of trips involved, and on the USAF's plan to watch for and avoid protected species, NMFS considers the risk of collisions between project-related vessels and protected species to be discountable.

**Cumulative impacts:** Based on the analysis in the CDEA (Pages 101-106), the USAF stated that the CSM demonstration would represent a one-time 7% increase in the number of annual launches from Vandenberg AFB, but the short-term increase in environmental stressors due to the demonstration would have no significant impact on biological resources. NMFS concurs.

**Conclusion:** NMFS concurs with your determination that conducting a single Demonstration Flight of the CSM from Vandenberg AFB, California to the USAKA RTS in the RMI is not likely to adversely affect ESA-listed marine species or their designated critical habitat. Our concurrence is based on the finding that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint USFWS-NMFS Endangered Species Consultation Handbook (USFWS-NMFS 1998) and summarized at the beginning of the Analysis of Effects section above. However, due to different evaluation criteria, additional compliance review (NEPA, Essential Fish Habitat, FWCA, etc.) will be completed by NMFS Habitat Conservation Division and may be forthcoming in a separate communication.

This concludes your consultation responsibilities under the ESA for species under NMFS's jurisdiction. Consultation must be reinitiated if: 1) a take occurs; 2) new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; 3) the identified action is subsequently modified in a manner causing effects to listed species or designated critical habitat not previously considered; or 4) a new species is listed or critical habitat designated that may be affected by the identified action.

If you have further questions please contact Donald Hubner on my staff at (808) 944-2233. Thank you for working with NMFS to protect our nation's living marine resources.

Sincerely,



William L. Robinson  
Regional Administrator

Cc: Alan Everson, Habitat Conservation Division, NMFS/PIRO  
Christina Fahy, ESA Team Lead, NMFS Southwest Regional Office, Long Beach  
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NMFS File No. (PCTS): I/PIR/2009/04478  
PIRO Reference No.: I-PI-09-772-LVA



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## ***APPENDIX F***

# ***US FISH AND WILDLIFE SERVICE BIOLOGICAL OPINION FOR ACTIVITIES AT US ARMY KWAJALEIN ATOLL/ REAGAN TEST SITE***



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office  
300 Ala Moana Boulevard, Room 3-122, Box 50088  
Honolulu, Hawaii 96850



In Reply Refer To:  
12200-2009-FA-0119

APR 09 2010

Tom Huynh, IA-4  
Chief, Acquisition Civil and Environmental Engineering  
USAF Space and Missile Systems Center/EAF  
483 North Aviation Boulevard  
El Segundo, California 90245-2808

Subject: Biological Opinion on the Effects of the Conventional Strike Missile  
Demonstration on Green (*Chelonia mydas*) and Hawksbill (*Eretmochelys  
imbricata*) turtles

Dear Mr. Huynh:

This responds to your October 21, 2009, request for consultation under section 3-4.5.3 (Procedures for Consultation on Endangered Resources) of the U.S. Army at Kwajalein Atoll Environmental Standards (UES) (11<sup>th</sup> edition) for the proposed Coordinating Draft Environmental Assessment (CDEA) for the Conventional Strike Missile (CSM) Demonstration. The U.S. Air Force (USAF) is the action agency for this project and is proposing to conduct a CSM Demonstration flight test in 2011 or 2012. A Minotaur IV Lite booster rocket will carry the payload, which will be launched from Vandenberg AFB, California. During its flight, a payload delivery vehicle (PDV) would separate from the booster as it travels towards U.S. Army at Kwajalein Atoll/Reagan Test Range (USAKA/RTS). The vehicle will begin to descend from the upper atmosphere and ultimately impact at Illeginni Islet, USAKA/RTS. This document represents the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of the proposed project on the green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*) that are listed as threatened and endangered respectively, under the U.S. Endangered Species Act (Act), and are USAKA Species of Concern for which consultation is triggered under the UES (section 3-4.5.3).

This BO is based on the following information: (1) the USAF October 21, 2009, CDEA; (2) biological literature (see Literature Cited section at the end of the document); and (3) other information sources. Our log number for this consultation is 12200-2009-FA-0119. Copies of pertinent materials and documentation are maintained in an administrative record in our Pacific Islands Fish and Wildlife Office (PIFWO) in Honolulu, Hawaii.





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**Consultation History**

- April 9, 2009: The Department of the Air Force, Space and Missile Systems Center (SMC) and the Department of the Army, Space and Missile Defense Command (USA/SMDC) presented the Conventional Strike Missile Demonstration Downrange Actions and Environmental Issues to the PIFWO and National Marine Fisheries Service representatives.
- June 1, 2009: The USAF/SMC released the Coordinating Draft Environmental Assessment for the Conventional Strike Missile Demonstration.
- June 24, 2009: The USAF/SMC requested to consult under the USAKA UES Section 3-4.5.3, with the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office.
- October 21, 2009: The USAF/SMC released a revised CDEA to the agencies on October 21, 2009, which is the agreed-upon date that formal consultation began. The CDEA serves as the Biological Assessment (BA) and serves to support the Notice of Proposed Action (NPA) for a Document of Environmental Protection (DEP) for species consultation under the UES.
- October 23, 2009: The USAF/SMC issued a revised request to consult under the UES based on its determination that the proposed Conventional Strike Missile Demonstration project may affect green turtles (*Chelonia mydas*), hawksbill turtles (*Eremochelys imbricata*), and nesting habitat at Illeginni Islet, Kwajalein Atoll, Republic of the Marshall Islands.

**BIOLOGICAL OPINION****Description of the Proposed Action**

This project description summarizes information taken from the October 2009 CDEA. The purpose of the CSM Demonstration flight test is to evaluate hypersonic glide technologies in support of the Conventional Prompt Global Strike (CPGS) program and to evaluate long-range, non-ballistic flight, and strike effectiveness. The purpose of the CPGS program is to enhance existing capacity to with conventional payloads. The CSM Demonstration flight test represents a component of a larger CPGS program to evaluate several delivery systems.

Prior to the CSM flight demonstration, support equipment and materials will be set up in the vicinity of the western end of Illeginni Islet, USAKA over an area of about two acres. Equipment would be set up primarily on managed vegetation and the paved helopad. Equipment set-up time would take about 30 days and equipment would remain in place for about 60 days leading up to the CSM flight demonstration, for a total of about 90 days of land disturbance time. It is anticipated that motorized equipment and personnel at Illeginni Islet may cause birds to leave the western end of the islet. The Service expects that these activities would also have a similar affect on sea turtles, since they generally exhibit shy behavior and are easily disturbed.

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The proposed action involves a single CSM Demonstration flight test. The CSM PDV would be launched from Vandenberg AFB using a Minotaur IV Lite booster over the Pacific Ocean. Three booster rocket stages would individually separate from the PDV, and would fall into the ocean between the west coast and Hawaii. After separation from booster rocket stages, the CSM PDV would glide at hypersonic velocities in the upper atmosphere towards the USAKA/RTS in the RMI. The CSM PDV will impact the vicinity of the western end of Illeginni Islet, USAKA/RTS. At a predetermined height above the impact area, the payload's 200-pound high-explosive package would detonate and disperse several thousand debris particles over the western end of Illeginni Islet. It is anticipated that all or most of the debris particles would fall within the designated area, as well as would other CSM PDV debris.

The CSM PDV is comprised of several components that include: structural, communications, power, propulsion and payload. The CMS PDV structure is comprised of aluminum, titanium, steel, tantalum, tungsten, carbon fabric, silica, beryllium, chromium and nickel. Communications equipment includes several 5- to 20-watt radio transmitters. Power is provided by five lithium ion and lithium thionyl chloride batteries, each weighing between 1 and 40 pounds. Propulsion components include three pounds of pressurized nitrogen gas. The payload is comprised of thousands of small debris particles, of a few inches in diameter, and many pounds of high explosives, for a total weapon weight of about 1,000 pounds. In addition, the PDV will include about ten small electro-explosive devices for mechanical systems operation purposes.

The USAF will prepare a detailed PDV debris recovery and clean-up plan that outlines all Post-test recovery activities and procedures for operations at Illeginni Islet. Recovery and clean-up operations will be conducted in a manner that minimizes further impacts to fish and wildlife resources. The recovery and clean-up plan will be developed in coordination with the Service and National Oceanic and Atmospheric Administration (NOAA).

CSM-related flight demonstration actions include the dispersal of thousands of debris particles over the designated impact area near the western end of Illeginni Islet. The USAF anticipates that all or most of the fragments will land within the impact area. The USAF does not expect the ricochet of debris particles off of any supporting structures that have been pre-positioned within the impact area. Also, all parts of the CSM PDV are anticipated to impact the ground within the impact area, and may form a crater of up to 20 to 25 feet across.

The USAF does acknowledge that a low level of risk exists with the pre-impact detonation at low altitude that may result in the dispersal of a few hundred payload debris particles beyond the target area that may impact habitat features such as vegetation, trees, beaches, the lagoon, and the ocean. PDV fragments landing outside of the designated target area may affect threatened and endangered sea turtles or nests and could result in fragment-related injuries or death to sea turtle adults, hatchlings or eggs. Sea turtles that are hit by high velocity fragments could be killed or injured and nests could be damaged.

Other flight-related impacts include a focused sonic boom that may measure about 156 decibels (dB) at the point of impact at Illeginni Islet. In addition to the focused sonic boom footprint, the detonation of the integrated payload just prior to PDV impact at a low altitude would generate very loud noise levels. A peak sound pressure level of 180 dB and peak overpressures of 2.78

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pounds per square inch (psi) from the detonation are anticipated at ground level at the impact site on Illeginni Islet.

At the completion of the CSM test and PDV impact at Illeginni Islet, qualified personnel would inspect the impact area for unexploded ordnance (UXO) and stabilize dust and disturbed soil using freshwater. When the site is safe, other support personnel will recover all visible payload particles and other PDV debris. Metal detectors and digging tools may be used to recover debris. Diving activities may be conducted in the lagoon or ocean by support personnel to recovery payload or PDV debris, if necessary.

### Conservation Measures

Implementation of actions (1.a – 1.d) at Eniwetak Islet will result in significant steps toward offsetting sea turtle nesting habitat losses that are anticipated to occur at Illeginni Islet. Also, action (1.e) represents a significant activity that the USAF and USAKA will incorporate into project planning to avoid or minimize impacts to sea turtle nesting habitat at Illeginni Islet. These activities will be undertaken as part of the process to develop a Document of Environmental Protection (DEP) for the Conventional Strike Missile project.

- 1.a. USAF, in coordination with the USAKA and the Service, will support: (1) An assessment of the rodent population at Eniwetak Islet; (2) if rodents exist at Eniwetak Islet, rodents will be completely removed from Eniwetak Islet as part of the DEP process for the Conventional Strike Missile project; (3) if rodents do not exist at Eniwetak Islet, an alternate location, such as Gellinam Islet, will be selected for rodent removal.
- 1.b. USAF will initiate coordination with the USAKA and the Service to establish protocols to remove all rodents from Eniwetak Islet (or Gellinam Islet). The protocols will address the issue of removing rodents in a manner that does not affect other fish and wildlife resources on land or in the ocean.
- 1.c. USAF in conjunction with USAKA will monitor Eniwetak Islet (or Gellinam Islet) to ensure that rodents have been completely eradicated and that the islet will remain without rodents for a duration of at least two years.
- 1.d. USAF in conjunction with USAKA will inspect all cargo and vehicles transiting from or to any USAKA location to ensure that future introduction of rodents is prevented for the duration of Conventional Strike Missile program at USAKA.
- 1.e. USAF in conjunction with USAKA will inspect beach areas for active sea turtle nests at Illeginni Islet, beginning 30 days prior to CSM PDV impact. If active nests are discovered, USAKA will immediately notify the Service, and implement Service recommendations to avoid or minimize project-related impacts to sea turtle nests.

### Status of the Species/Critical Habitat

Information in this section is taken from the *Recovery Plan for U.S. Pacific Populations of the Green Turtle* (NMFS and USFWS, 1998), *Green Sea Turtle (Chelonia mydas) 5-Year Review*:

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*Summary and Evaluation* (NMFS and USFWS, 2007), *Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle (Eretmochelys imbricata)* (NMFS and USFWS, 1998), *Hawksbill Sea Turtle (Eretmochelys imbricata) 5-Year Review: Summary and Evaluation* (NMFS and USFWS, 2007), unless otherwise noted.

### Species Description

#### Green Turtle

The green turtle (*Chelonia mydas*) is the largest member of the marine turtle family Cheloniidae and is found throughout the Pacific, Indian, and Atlantic oceans and the Mediterranean Sea. Green turtles are distinguished from other sea turtles by their smooth carapace with four pairs of lateral scutes, a single pair of prefrontal scutes, and a lower jaw-edge that is coarsely serrated. Adult green turtles may weigh more than 220 pounds and exceed three feet in carapace length. The common name of this species refers to the green color of its subdermal fat. The carapace color of adult turtles ranges from light to dark brown, sometimes with an olive cast, radiating or wavy lines, and/or dark blotches. The plastron typically is yellowish to orange, and in the east Pacific often has a grayish cast.

The major taxonomic split within this species is between populations in the Atlantic/Mediterranean and populations in the Pacific/Indian oceans. Although the populations of green turtle in the East Pacific have traditionally been referred to as a distinct subspecies (*C. mydas agassizii*), this distinction as yet has no documented genetic basis. Nevertheless, mitochondrial DNA studies have revealed fixed or near-fixed genotypic differences among nesting populations. This genetic substructure underlies the natal-beach homing behavior of reproductive female turtles. For management and conservation purposes, each nesting population must be treated as an independent demographic unit.

The green turtle was listed in 1978 as threatened under the Endangered Species Act (Act) throughout its Pacific range because of overexploitation, habitat loss, lack of regulation and adequate enforcement, and evidence of declining numbers. Populations nesting in Florida and on the Pacific coast of Mexico are classified as endangered under the Act. The green turtle is also classified as endangered worldwide by the International Union for the Conservation of Nature and Natural Resources, and it is listed in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Because of its status as a federally and internationally protected species, green turtles were included among other sensitive animals afforded special protection at USAKA under the UES in 1995. In 1998, the NMFS and the Service completed a recovery plan for the U.S. Pacific populations of the species.

#### Hawksbill Turtle

Hawksbills are recognized by their relatively small size (carapace length less than 3 feet), narrow head with tapering beak, and strongly serrated posterior margin of the carapace and thick, overlapping shell scutes. In addition, *Eretmochelys imbricata* may be distinguished from *Chelonia mydas* by the transverse division of the prefrontal scales into two pairs (these scales are elongate and undivided in *Chelonia*) (Pritchard and Trebbau 1984). The carapace of adult turtles is dark brown with faint yellow streaks and blotches; the scales on the dorsal side of the flippers

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and head are dark brown to black with yellow margins; the ventral side of the flippers and the plastron are pale yellow, with scattered dark scales on the flippers (Witzell and Banner 1980).

Carr (1952) proposed subspecific separation of the Atlantic and Indo-Pacific types based on coloration and carapace shape. The Indo-Pacific subspecies, *E. i. squamata*, is solid black on the dorsal surface of the flippers and head, and the carapace is more heart-shaped (Witzell 1983). The Atlantic hawksbill, *E. i. imbricata*, is less black on the dorsal surface of the flippers and head, and the carapace is more straight-sided and narrowly tapered posteriorly (Witzell 1983). For the purposes of the Hawksbill recovery plan, a single taxonomic entity, *Eretmochelys imbricata*, within the Pacific shall be assumed until additional genetic information on zoogeographic distribution is received.

The hawksbill turtle is threatened with extinction throughout its range. It is considered universally endangered in the International Union for the Conservation of Nature (IUCN) Red Data Book (Baillie and Groombridge 1996) and is included in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (most endangered). The hawksbill is protected as an endangered species under the U.S. Endangered Species Act, for Pacific territories (Guam and American Samoa) and commonwealths (Northern Marianas Islands) of the United States and for certain independent states, such as the Republic of the Marshall Islands, Federated States of Micronesia and the Republic of Palau through cooperative agreements.

### Biological Characteristics

#### Green Turtle

Throughout their range, adult green turtles typically are resident in foraging areas (e.g., seagrass or macro-algae habitats). Periodically, turtles migrate long distances to breeding areas where copulation and nesting take place. Mating usually terminates when nesting has commenced. Based on growth rates observed in wild green turtles, females are thought to reach sexual maturity at 25 years of age or later (Eckert 1993). Reproductive females generally nest every year, but may skip years. Adult males may migrate and breed every year. Females emerge from the sea to nest 25-35 days after copulation. Green turtles may lay up to six clutches in one season, and each clutch may contain about 100 eggs. After the female has laid the eggs and covered them, the eggs incubate in the soil for up to two months (mean = 64.5 days Balazs 1980). Hatchlings are photopositive and may be disoriented from their search for the sea by artificial light.

Green turtles prefer areas where surface water temperatures are no lower than about 68 degrees Fahrenheit in the coldest month; for example, during warm spells (e.g., El Niño), green turtles may be found considerably north of their normal distribution. Based on the behavior of post-hatchlings and juveniles raised in captivity, it is presumed that those in pelagic habitats live and feed at or near the ocean surface, and that their dives do not normally exceed several feet in depth (NMFS and USFWS 1998). The maximum recorded dive depth for an adult green turtle was 361 feet (NMFS and USFWS 1998), while subadults routinely dive 66 feet for 9-23 minutes, with a maximum recorded dive of 66 minutes (NMFS and USFWS 1998). Additionally, it is presumed that drift lines or surface current convergences are preferential zones due to increased

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densities of likely food items. In the western Atlantic, drift lines commonly contain floating *Sargassum* capable of providing small turtles with shelter and sufficient buoyancy to raft upon (NMFS and USFWS 1998).

Sea turtle gender is primarily determined by nest temperature (Mrosovsky and Yntema 1980; Yntema and Mrosovsky 1980; and Morreale *et al.* 1982). Clutches produced between 81 degrees Fahrenheit and 87 degrees Fahrenheit are usually mixed gender. Eggs incubated when average temperatures fall below 81 degrees Fahrenheit during the middle trimester produce males, while females are usually produced when temperatures exceed 87 degrees Fahrenheit (Alvarado and Figueroa 1987).

Most green turtles appear to have a nearly exclusive herbivorous diet, consisting primarily of sea grass and algae (Wetherall *et al.* 1993). In some areas, such as along the eastern Pacific coast, green turtles display carnivory, feeding on molluscs and polychaetes, fish, fish eggs, and jellyfish. In the Hawaiian Islands, green turtles are site specific, feeding consistently in the same areas (NMFS and USFWS 1998).

## Hawksbill Turtle

The Hawksbill has the potential to be a long range migrant. It is likely that adult hawksbill movements will perform regular migratory movements among a preferred nesting beach, a breeding ground and a persistent foraging territory. The distances between these territorial foci vary greatly and appear to be of random length among individuals.

The geographic proximity of an adult's foraging habitat in relation to its natal beach is not known, and the same must be said for juveniles as well. Once a foraging or nesting site is chosen, hawksbills tend to be persistent in the continuing use of that site. However, hawksbills can move long distances and it possible that nesting and foraging animals observed in such localities as the Republic of Palau or Saipan have potential home ranges extending throughout the islands of Micronesia and Melanesia and even the waters of the Phillipines, Indonesia and Australia.

Hawksbills have been classified as opportunistic feeders on a wide variety of marine invertebrates and algae (Car and Stancyk 1975; Witzell 1983). However, Balazs (1978) reported that the stomach and intestine of a Hawaiian hawksbill were completely filled with three kinds of unidentified sponges. Meylan (1988) and others (Vicente 1994) have confirmed that hawksbills appear to be specialist sponge carnivores, selecting just a few genera of sponges throughout the Caribbean Sea for their principal diet. There are very few vertebrates capable of digesting sponges without being injured by the sponges silicate spicules (needles), but hawksbills apparently can. Much of the other material found in hawksbill stomachs appears to have been ingested coincidentally while the animal was feeding on sponges.

Regarding nesting periods, a rough monthly estimate of numbers of hawksbill nests per survey in the Rock Islands of Palau indicated a possible bi-modal season (December – February and June-August) (Maragos 1991). A hawksbill adult female was observed digging a nest and dropping eggs on Omelek Islet, Kwajalein Atoll, RMI in mid-May, 2009. On July 5, several hatchlings were observed leaving the nest and heading to the shoreline. On July 9, the nest was excavated



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and produced 5 live hatchlings that were released and allowed to wander to the shore and swim away (Mike Malone, Kwajalein Range Systems, pers. comm).

There is much variation in clutch size from site to site (Witzell 1983). Maragos (1991) estimated 130 eggs per clutch for Palauan hawksbills. An average of 131.8 (range 89-192) eggs per clutch was measured for 47 nests from Campbell Island (Limpus *et al.* 1983). For the Omelek Islet nest, 101 empty egg shells were counted, 5 hatchlings were rescued and released, 13 infertile eggs were recovered from the nest and 2 fully developed eggs (possibly crushed), were documented from the nest, for a total of 121 eggs.

### **Population Dynamics and Distribution**

#### **Green Turtle**

The absolute number of green turtles in any population is difficult to assess. The size of a population typically can only be measured as the relative abundance of nesting females. Reproductive longevity estimates suggest that a female may nest 3 to 11 seasons over the course of her life. Based on the reasonable means of 3 nests/season and 100 eggs/nest (Hirth 1997), a female may deposit 9 to 33 clutches, or about 900-3,300 eggs, during her lifetime.

Historical and recent accelerated rates of exploitation of green turtles have lead to significant declines in their distribution and resulted in fewer and smaller remaining breeding sites. In the western Pacific, the only major (greater than 2,000 nesting females) populations of green turtles occur in Australia and Malaysia. Smaller colonies occur in the insular Pacific islands of Polynesia, Micronesia, and Melanesia (Wetherall *et al.* 1993) and at French Frigate Shoals (FFS) and scattered locations in the Hawaiian Archipelago (Balazs 1995). In the Marshall Islands, Bikar Atoll may support between 100 and 500 nesting females (Puleloa and Kilma 1992), and between 25 and 100 nests may occur at Erikub, Jemo and possibly Ailinginae Atolls (Puleloa and Kilma 1992). Other atolls may support low level nesting (less than 25 nests) activities, but little information is available concerning current breeding success in these areas.

Although attempts have been made to model the population dynamics of green turtles, few data are available that describe key life history traits, such as growth rates, recruitment, and mortality that influence the population variability and stability of this species (Chaloupka and Musick 1997).

#### **Hawksbill Turtle**

Hawksbill turtles are circumtropical in distribution, generally occurring from 30 degrees north to 30 degrees south latitude within the Atlantic, Pacific and Indian Oceans and associated bodies of water. Along the eastern Pacific rim, hawksbills were apparently common to abundant as recently as the 1930s in nearshore waters from Mexico to Ecuador, particularly the eastern coast of Baja California Sur in the vicinity of Concepcion Bay and Paz Bay, Mexico (Cliffon *et al.* 1982).

Within the Central Pacific, nesting is widely distributed but scattered and in very low numbers. Foraging hawksbills have been reported from virtually all of the island groups of Oceania, from

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the Galapagos Islands in the eastern Pacific to the Republic of Palau in the western Pacific (Witzell 1983; Pritchard 1982). The largest remaining concentrations of nesting hawksbills occur in remote oceanic islands of Australia (Torres Strait) and the Indian Ocean (Republic of the Seychelles), but additional nesting concentrations of significance likely exist in other areas not yet sufficiently surveyed. This is particularly true of remote beaches in the Solomon Islands, Papua New Guinea, Indonesia and Malaysia.

Throughout the vastness of Micronesia, the nesting picture for hawksbills appears grim. If the Republic of Palau represents the highest hawksbill nesting activity known in the region, with conceivably as few as 20 nesting females per year, then all of Micronesia with its thousands of islands and atolls may not support collectively more than a few hundred nesting females per year. The situation is hardly better in the Central and South Pacific. The island of Hawaii remains a bright hope, with an unexpected number of nesting hawksbills discovered and the environmental mandates are in place for absolute protection of animals, eggs and nesting habitat.

For the Republic of the Marshall Islands, information on hawksbill nesting is scarce. This is probably due more to a lack of surveys than lack of nesting. Puleloa and Kilma (1992) suggest that nesting of hawksbills on Wotje Atoll may occur regularly. Specific occurrences of nesting at Wotje were noted from the summer of 1991 on the southwest beach of Wotje Isle and in 1989 a nesting was attempted on Nibung Islet.

### **Status and Threats**

#### **Green Turtle**

Nesting populations are doing relatively well in the Pacific, Western Atlantic and Central Atlantic Ocean. In contrast, populations are doing relatively poorly in Southeast Asia, Eastern Indian Ocean, and perhaps the Mediterranean. Three nesting sites have shown an increase in abundance (Heron Island, Australia, Raine Island, Australia, and Ogasawara Islands, Japan), while a fourth (Guam) appears stable. The green turtle nesting concentrations at East Island in the French Frigate Shoals (Hawaii, USA) is the largest in the Central Pacific. Since the initial nesting surveys in 1973, there has been a marked increase in annual green turtle nesting at East Island.

Continued poaching, incidental take by sport and commercial fishing gear, and the incidence and severity of tumors caused by a fibropapilloma disease in Hawaii, all act to compromise the green turtle's recovery. Fibropapilloma is often fatal and its etiology is unknown. Green turtles, like all sea turtle species, are vulnerable to anthropogenic impacts during all life-stages, from eggs to adults. Three of the greatest threats to green turtles result from intentional killing for commercial and subsistence use. These include take of eggs, killing of females on nesting beaches, and directed hunting of green turtles in foraging areas. Fisheries bycatch is also a major issue.

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### Hawksbill Turtle

Turtles have been harvested for centuries by native inhabitants of the Pacific region. In modern times, however, a severe overharvest has resulted from a variety of factors, among which is the loss of traditional restrictions that had limited the numbers of turtles taken by island residents. Brought about by modernized hunting gear, and easier boat access to remote islands where turtles nest, extensive commercial exploitation has replaced subsistence harvest for turtle products in both domestic markets and international trade, and is maintained by inadequate regulations and education. One often-mentioned aspect of this problem is the pillage of wildlife on remote islands by supply ships and commercial fishing crews.

Anecdotal observations throughout Micronesia, from across the Pacific, and from other tropical oceans of the world are in near total agreement that current stock sizes are significantly below historical numbers. Although quantitative historical records are few, dramatic reductions in numbers of nesting and foraging hawksbills have apparently occurred in Micronesia (Johannes 1986; Pritchard 1982a) and Pacific Mexico just south of California (Clifton *et al.* 1982) since World War II, largely because of increased access to remote nesting beaches by indigenous fishermen equipped with spear guns, outboard motors SCUBA, and other high-tech fishing gear. Market pressures from Asia, sustained by a vast fleet of Taiwanese and other fishing vessels of various national origins, are overwhelmingly the existing stocks. Most important of all hawksbills are threatened by a pervasive tortoiseshell trade, which continues particularly in southeast Asia and Indonesia even though the once-lucrative Japanese markets were closed in 1994.

Primary turtle threats in the Republic of the Marshall Islands include directed take and increased human presence. There is limited information regarding turtle threats in the 34 atolls and large islands of the RMI. The consumption of nesting turtles and their eggs appears to be the single-most important source of mortality of turtles. Turtle harvest has expanded to all of the atolls, with Majuro and the Southern Islands purchasing turtles caught from the Northern Islands where they nest. There is little or no control over the harvest on any of the islands, although informal control comes from the owner of the land (upon which the turtles are nesting). The turtles are primarily harvested from the nesting beaches and are generally taken for celebrations. Turtle eggs are regularly eaten. Also, eggs are hatched and the young kept as pets. In some cases the practice of raising young is mistakenly believed to be a good conservation practice. Coastal construction on several atolls may also degrade beach nesting sites. Poaching by foreign fishermen is possibly a serious threat on the uninhabited atolls of Bokaak, Bikak, Taka, Jemo, Erikub, Ailinginae and Rongrik.

### Environmental Baseline

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area contemporaneous with the consultation in process. In this case, the baseline includes RMI, local, and private actions that affect the species at the time the consultation begins. Unrelated Federal actions that have already undergone consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are also included in the environmental baseline.

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Status of species within the action area

In the Marshall Islands, sea turtle nesting generally occurs between May and November, with some exceptions of nesting observed in December. At Illeginni Islet, the western shoreline (inter-islet reef flat) and northwestern shoreline (lagoon facing) are suitable nesting locations for sea turtles (USFWS and NMFS 2000). Three nest pits were observed at the western shoreline by Service and NMFS biologists in 1996 (USFWS and NMFS 1996).

Factors affecting species environment within the action area

Few data are available to assess population dynamics for sea turtle species within the Marshall Islands. Green turtles and hawksbill turtles are at risk from human harvest of adults, juveniles and eggs; incidental take by fishing gear; marine debris; egg and hatchling predation by rats; and loss of nesting habitat due to human encroachment and construction in areas previously used by sea turtles (McCoy 2004). Green turtles and hawksbill turtles nesting in the Marshall Islands may be highly sensitive to any perturbations that take place at existing nesting sites.

Existing activities that affect green turtles at Illeginni Islet include: (1) Re-entry vehicles have been documented to impact and contaminate sea turtle nesting habitat at Illeginni Islet; (2) general USAKA operations (*e.g.*, maintenance of existing infrastructure, refurbishment activities and heli-pad) which may interrupt attempts by female green turtles to haul-out and nest on the islet; (3) release of hazardous materials during the detonation of unexploded ordnance at the designated ordnance burn site (western end of islet) which may disturb egg incubation, sea turtle haul-out, or hatchling migration to the ocean; (4) the harvest of green turtle eggs, juveniles and adults by humans for subsistence purposes; and (5) egg and hatchling predation by rats (*Rattus* spp.).

**Effects of the Action**

Sea turtles (*e.g.*, adults, hatchlings, or eggs) or turtle nesting habitat may be destroyed when the CSM debris particles or PDV impact at Illeginni. It is also possible that turtle nests may be impacted during equipment set up or cleanup activities. In the event CSM debris particles or CSM PDV land on or heavy equipment traverses across turtle nesting habitat, it is possible that sea turtle adults or turtle eggs may be severely damaged or destroyed, and that the suitability of the habitat for future successful nesting may be eliminated by associated physical changes to that habitat. Also, peak sound pressure level of 180 dB and peak overpressures of 2.78 psi from the detonation are anticipated at ground level at the impact site on Illeginni Islet. Such sound levels would potentially be lethal to humans at the point of impact. Sound at these levels could also break windows or crack plaster in structures near the site. The Service anticipates these levels of sound pressure and overpressure would also be lethal for sea turtles (*e.g.*, adults, hatchlings and eggs) at Illeginni Islet.

The overall effect of the action would not benefit green turtles or hawksbill turtles and other wildlife on Illeginni Islet. CSM PDV impacts and recovery activities are expected to result in additional degradation to shoreline areas that support such habitat, which is currently stabilizing from previous operational impacts. Without the proposed action, it is feasible that sea turtle

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nesting habitat may stabilize, particularly if other negative influences could be eliminated or controlled in concert, to support viable nesting.

Prior to the CSM demonstration test, USAKA and Service staff will inspect sea turtle nesting habitat to ensure that no sea turtles are hauled out or active nests exist that could be affected by the CSM debris particles or PDV. The USAF has projected that approximately one CSM PDV will impact at Illeginni in 2011 or 2012. It is also feasible that CSM PDV generated aerosolized sediment plumes may negatively affect sea turtles since these plumes may contain contaminants. The window of time that sea turtles may be exposed to CSM PDV aerosolized sediment plumes is considered quite low. However, it is possible that sea turtles may be exposed to contaminated sediment plumes and as a result, their health may be degraded.

Service and National Marine Fisheries Service (NMFS) biologists will provide guidance during recovery operations to minimize impacts to fish and wildlife resources. An aerial survey will be conducted over the islet within several hours after the test to survey for any dead or injured marine animals or sea turtles. Also, USAKA/RTS, USFWS, and/or NMFS biologists would conduct surveys at Illeginni Islet and in the near-shore waters for any injured fish and wildlife resources or damage to sensitive habitats. A pre-demonstration flight survey cannot be completely risk-free and there is no way to assure that no migratory birds or sea turtles found at or near Illeginni islet would be injured. Therefore, Service employees would do a post-flight assessment and will assist the USAF and USAKA to recover and rehabilitate injured birds or sea turtles.

The proposed action may, however, result in take in the form of harm or harassment of green turtles by precluding females from haul-out and nesting, preventing normal embryonic development, disturbing or destroying turtle nests, and compromising hatchling growth and success. In addition, it is anticipated that a single CSM PDV impacting on Illeginni can produce a crater approximately 20 to 25 feet across and eject sediments (*e.g.*, primarily coral rubble) from the crater across the islet. Just one such event has the potential to essentially render viable sea turtle nesting habitat permanently unsuitable for successful nesting, and injure or kill hatchlings at Illeginni Islet.

Three sea turtle nests at Illeginni Islet were observed by the Service during the USAKA biennial survey in 1996. Though the nests were not disturbed, we anticipate that each clutch may contain about 130 eggs (Maragos 1991), or about 390 eggs total at the nesting site. Potential project-related impacts to eggs include direct impacts from CSM PDV's, pre-test equipment set-up, post-impact refurbishment activities (*e.g.*, earth moving equipment), or from exposure to contaminants mobilized during PDV impact.

Certain components of the CSM PDV are comprised of small amounts of Beryllium (Be). When the CSM PDV impacts on Illeginni Islet or the shallow nearshore marine environment, it breaks up. As heavy metals mix into the Illeginni environment, they may present an exposure risk, primarily to animals. Exposure to potentially toxic levels of heavy metals has been documented in test animals to result in growth anomalies, tumors, pneumonitis, hypersensitivity, cancer and death (T.C. Pellmar *et al.* 1999; Hoffman *et al.* 2003; Klaassen *et al.* 1986; and Lewis 1998). Calculations show that the quantity of each of the metals in the PDV will lead to very low concentrations of these metals in soil. The concentrations are a factor of 100 to 1000 times lower

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than current EPA guidelines for the concentration of these elements in residential soil and far below toxic concentrations for humans. While there is currently no data that suggests sea turtle exposure to these concentrations would result in harm to the species, the Service recommends that sea turtle exposure to Be should be investigated.

Soil sampling for Be was conducted at an RV impact site in 1992 that resulted in the identification of Be concentrations of about 5 parts per million, very near background levels. Though Be is known to be highly insoluble (USAF, 2004), sea turtles have not been evaluated for toxic exposure to Be, and it is feasible that the health of nesting females, embryos, and hatchlings at Illeginni may be degraded, resulting in reduced ability of the animal to resist diseases, successfully evade predators, forage or reproduce.

Removal of rodents from Eniwetak Islet (or Gellinam) would protect sea turtle nests from disturbance. A hawksbill turtle nest was recently observed at Omelek Islet by RTS and Space-X Staff. RTS staff documented that about 101 empty egg shells were retrieved from the nest, 5 live hatchlings, 13 infertile eggs and 2 eggs that developed but did not hatch, for a total of about 121 eggs documented at this nest. Approximately 106 hatchlings successfully developed from this nest. Therefore, we estimate the productivity of the nesting area at Eniwetak Islet to be about 130 eggs for sea turtle nests. Estimates of replacement vary considerably (e.g., 5,000 to 12,000 eggs = 1 adult) (P. Jokiel, pers. communication; and Limpus and Balazs 1991), but suggest that relative contributions of the conservation area, though similar to potential losses at Illeginni, would be modest, but would likely offset losses that may occur due to implementation of the proposed action.

### **Cumulative Effects of Non-Federal Activities**

Cumulative effects include the effects of future Republic of the Marshall Islands, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 3-4.5.3 of the UES.

Though Illeginni Islet is a USAKA-leased islet and closed to public access, it is possible that humans may gain access to the islet and harvest eggs or adult sea turtles.

### **Conclusion**

After reviewing the current status of the green turtle and hawksbill turtle, the environmental baseline for the action area, the effects of the proposed shoreline stabilization, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for this species; therefore, none will be affected.



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## INCIDENTAL TAKE STATEMENT

Section 3-4.8.1 of the UES prohibits the take of endangered and threatened species, respectively. Incidental take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

The measures described below are non-discretionary, and must be undertaken so that they become binding conditions. Because USAKA has command over all United States Government activities at USAKA-controlled islands, the Mid-Atoll Corridor, and USAKA-controlled activities within the RMI, these measures will be implemented by USAKA. However, the USAF must support implementation of these measures in coordination with USAKA. Furthermore, the USAF has a continuing duty to regulate the activity, in coordination with USAKA, covered by this incidental take statement. If the USAF (1) fails to support implementation of the terms and conditions or (2) fails to adhere to the terms and conditions of the incidental take statement, USAKA and the RMI may seek to enforce the terms. In order to monitor the impact of incidental take, the USAF must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.

### Amount or Extent of Incidental Take

The Service anticipates incidental take to occur in the form of harm or harassment to the breeding success or loss of up to three turtle nests or injury or loss of up to 390 eggs or hatchlings as a result of project-related CSM PDV impacts at Illeginni Islet.

### Effect of the Take

The Service does not believe that this level of incidental take is likely to result in jeopardy to the species or destruction or adverse modification of critical habitat, as critical habitat is not designated in the project area. The level of take is not likely to result in jeopardy because the overall effect of the action will likely affect no more than three sea turtle nests or approximately 390 eggs at Illeginni Islet. Furthermore, these losses are expected to be offset by the implementation of conservation measures to protect green turtle or hawksbill turtle nesting habitat at Eniwetak Islet. It is expected that about three sea turtle nests with an anticipated production of up to at least 390 sea turtle eggs will be protected at Eniwetak Islet (or Gellinam) during the life of the Conventional Strike Missile program at USAKA.

### Reasonable and Prudent Measures

The reasonable and prudent measures given below, with their implementing terms and conditions, are designed to minimize the impacts of incidental take that might otherwise result from the proposed actions. If, during the course of the actions, the level of incidental take is

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exceeded, the action agency is required to reinitiate consultation and review the reasonable and prudent measures provided in this biological opinion. In addition, the U.S. Air Force must cease the activities that caused the taking; must immediately provide an explanation of the causes of the taking; and must review with the Service the need for possible modification of the reasonable and prudent measures.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts on green turtles and hawksbill turtles:

1. Minimize the number of nests destroyed.
2. Monitor and report any incidental take that occurs.

### **Terms and Conditions**

In order to be exempt from the prohibitions of section 3-4.8.1 of the UES, the USAF must comply with the following terms and conditions, which implement reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

In order to implement reasonable and prudent measure 1 above, the following term and condition applies:

1. The USAF will aim the CSM PDV away from the known sea turtle nesting areas within the Mid-Atoll Corridor Impact Area.

In order to implement reasonable and prudent measure 2 above, the following terms and conditions apply:

- 2.a. The USAF will work with the USAKA Environmental Management Office and USFWS to inspect the CSM PDV impact zones to assess sea turtle mortality after the CSM Demonstration Flight Test. Baseline data will be collected at Illeginni prior to the Demonstration Flight Test for comparison purposes.
- 2.b. The USAF will submit a report by December 31 of the year in which the CSM Demonstration Flight Test was conducted to USAKA that describes sea turtle impacts or any take that may have occurred at Illeginni Island.
- 2.c. The USAKA Environmental Management Office will forward the report to the PIFWO Field Supervisor at the above address documenting take of green turtles or hawksbill turtles and suggesting ways to further minimize incidental take at Illeginni Islet.

The PIFWO believes no more than 3 nests per year will be precluded from reaching complete incubation (*i.e.*, hatching). The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided in this BO. The USAF must

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immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

### Conservation Recommendations

Federal agencies may carry out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information. When recommendations are provided, they relate only to the proposed action and do not necessarily represent complete fulfillment of an agency's responsibilities for the species.

- 1.a. The USAF may conduct a risk analysis of sea turtle exposure to Be at Illeginni. Rats (*Rattus* sp) that occur within the vicinity of sea turtle nesting sites may be used as surrogates to supplement this analysis. The analysis should evaluate concentrations of Be in the kidney, liver, bone and lung tissue.

The Final BO and this consultation are based on the action described in the October 21, 2009, CDEA for the Conventional Strike Missile Demonstration Test when USAF has submitted final comments. Reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions concerning this BO, please contact Marine Ecologist Kevin Foster (phone: 808/792-9420; fax: 808/792-9581).

Sincerely,



for Loyal Mehrhoff  
Field Supervisor

cc: NMFS- PIRO  
EPA-San Francisco  
USAF  
USAKA  
RMI-EPA

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***APPENDIX G***

***COMMENTS AND RESPONSES ON THE  
DRAFT ENVIRONMENTAL ASSESSMENT***

**Comments and Responses on the  
Draft Environmental Assessment for  
Conventional Strike Missile Demonstration**

This appendix contains a photocopy of the comment documents received on the Draft Environmental Assessment (EA). During review of the Draft EA, the USAF received only one comment letter. In the following letter, comment numbers have been added along the right margin and are numbered sequentially. A corresponding list of USAF responses to the comments is provided immediately following the letter.



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office  
300 Ala Moana Boulevard, Room 3-122, Box 50088  
Honolulu, Hawaii 96850



In Reply Refer To:  
12200-2010-CPA-0146

JUL 22 2010

Mr. Thomas T. Huynh, IA-4  
Chief, Acquisition, Civil and Environmental Engineering  
USAF SMC/EAF  
483 North Aviation Boulevard  
El Segundo, California 90245-2808

Subject: Draft Environmental Assessment for Conventional Strike Missile Demonstration

Dear Mr. Huynh:

This is in response to your letter dated June 11, 2010, received June 21, 2010, requesting the U.S. Fish and Wildlife Service (Service) to review and comment on the Draft Environmental Assessment (EA) for the Conventional Strike Missile (CSM) Demonstration. The proposed project is sponsored by the U.S. Air Force. The following comments have been prepared pursuant to the National Environmental Policy Act of 1969 [42 U.S.C. 4321 *et seq.*; 83 Stat. 401], as amended; the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended (FWCA); the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*; 87 Stat. 884], as amended (ESA); and other authorities mandating Service's concern for environmental values. Based on these authorities, we offer the following comments for your consideration.

### Proposed Action

The proposed project involves launching a Minotaur IV Lite vehicle, which is a modified, three stage, intercontinental ballistic missile. The three stages of the vehicle include a solid-propellant booster, a guidance and control assembly and a payload assembly. The payload delivery vehicle (PDV) is similar to the HTV-2 vehicle and uses hypersonic technology. The PDV measures about 20 feet in length, 7.7 feet wide and weighs approximately 3,200 pounds. The PDV structure is comprised of aluminum, titanium, steel, tantalum, tungsten, carbon fabric, silica and small amounts of beryllium, chromium and nickel. The PDV would carry approximately 850 pounds of payload, including several thousand debris particles, up to 200 pounds of high explosives and 10 small electro-explosive devices. The demonstration flight would originate at

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Mr. Thomas T. Huynh

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Vandenberg Air Force Base. The preferred land impact alternative is at Illeginni Islet, U.S. Army at Kwajalein Atoll/Reagan Test Site (USAKA/RTS), Marshall Islands. At a low altitude above Illeginni Islet, the high explosive payload would be detonated and the payload particles would be dispersed over the western end of the islet.

The broad ocean area alternative (BOA) would involve positioning three ocean going deck barges that would be secured together as a single impact platform. The steel-hulled barges would collectively measure 300 feet wide and 900 feet long. The barges would be towed to an ocean area north of Kwajalein Atoll, and maintained in place by four unmanned diesel-powered outboard thrusters. Approximately 38 gallons of diesel fuel and several gallons of coolant, oil and hydraulic fluid would be contained within the barge system to support the thrusters. Similar to the preferred alternative, the PDV would detonate and disperse its payload of small particles over the barge impact platform and the ocean area adjacent to the barges.

2

Also under consideration is the No Action alternative in which the CSM demonstration flight test would not be conducted.

### Anticipated Project Impacts

At Illeginni Islet, a significant portion of the migratory bird population that resides on the western end of the islet will be exposed to potentially lethal sound pressure levels (180 dB peak pressure in the air) as a result of the aerial payload detonation.

3

It is anticipated that payload detonation and PDV land-related impacts may impact an area of at least 2 acres (0.8 hectares) in size. However, it is feasible that several hundred payload particles may disperse beyond the intended impact area and affect the nearby *Pisonia* forest and possibly land on the lagoon-side and ocean-side coral reefs. It is also possible that migratory birds, green turtles (*Chelonia mydas*) or hawksbill turtles (*Eretmochelys imbricata*) may be injured or killed as a result of physical impacts associated with the dispersal of thousands of payload particles at Illeginni Islet. In addition, active green or hawksbill turtle nests could be destroyed by the impacts. Finally, a crater up to 25 feet across may be formed within the planned impact area when the PDV impacts the islet.

4

For impacts within the BOA, underwater peak overpressures may be as high as 206 dB within the planned impact area. This may cause injury to marine mammals and turtles within the detonation impact area.

5

Thousands of particles and possibly the PDV would impact the target barges under the BOA and it is feasible that many particles and possibly the PDV may fall directly into the ocean. Marine mammals or turtles may be injured or killed should they come in close proximity to the barges at the time of the PDV aerial detonation.

No impacts are anticipated to occur in conjunction with the No Action alternative.



Mr. Thomas T. Huynh

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### **Assessment, Avoidance and Conservation Measures**

A Biological Opinion (BO) was prepared by the Service under the authority of the USAKA Environmental Standards, which are specific to the U.S Army's Kwajalein Atoll jurisdiction. The following conservation measures were developed cooperatively by the USAF and the Service to offset anticipated impacts at Illeginni Islet.

Biologists from the Service and National Marine Fisheries Service (NMFS) would perform pre-flight demonstration test biological surveys at Illeginni. The biological surveys would be conducted to describe baseline conditions of terrestrial and marine habitats. During the post-flight test demonstration period, Service and NMFS biologists would work with USAKA/RTS personnel to recover and rehabilitate wildlife, such as migratory birds or turtles, as well as evaluate impacts to habitat that may have been affected as a result of the demonstration test at Illeginni Islet.

To minimize the threat that sound pressure and direct physical impacts may have on wildlife, USAKA/RTS personnel will be directed to implement hazing techniques to scare birds from the impact area at Illeginni Islet. Also, at least 30 days prior to the demonstration test, routine inspections will be conducted within potential turtle nesting areas to identify turtle nesting sites. USAKA/RTS will contact the Service for guidance in the event active nesting sites have been identified at Illeginni Islet. Likewise, USAF in conjunction with USAKA will inspect all cargo and vehicles transiting from or to any USAKA location to ensure that future introduction of rodents is prevented for the duration of Conventional Strike Missile program at USAKA.

Finally, the USAF has agreed to implement conservation measures, in coordination with the USAKA and the Service that conserve fish and wildlife resources, including migratory birds, turtles and nesting habitat at another USAKA islet. As part of this agreement, the USAF will support an assessment of the rodent population at Eniwetak Islet. If rodents exist at Eniwetak Islet, they will be completely removed from Eniwetak Islet. If rodents do not exist at Eniwetak Islet, an alternate location, such as Gellinam Islet, will be selected for rodent removal.

The USAF has agreed to initiate coordination with the USAKA and the Service to establish protocols to remove all rodents from Eniwetak Islet (or Gellinam Islet). The protocols will address the issue of removing rodents in a manner that does not affect other fish and wildlife resources on land or in the ocean. Also, the USAF in conjunction with USAKA will monitor Eniwetak Islet (or Gellinam Islet) to ensure that rodents have been completely eradicated and that the islet will remain without rodents for at least two years. The details of these measures will be discussed as part of the Document of Environmental Planning process for the Conventional Strike Missile Project.

Mr. Thomas T. Huynh

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In conclusion, we concur with the proposed conservation measures to offset the anticipated impacts of the project. In addition, we recommend the USAF prepare an adaptive management plan to ensure successful implementation of the proposed conservation measures.

6

The Service appreciates the opportunity to comment on the Draft EA. If you have any questions regarding these comments, please contact Marine Ecologist Kevin Foster by telephone at (808) 792-9420 or by facsimile transmission at (808) 792-9581.

Sincerely,



for Loyal Mehrhoff  
Field Supervisor

cc: ACOE-Honolulu,  
NMFS-PIRO-Honolulu  
USEPA-Region IX, San Francisco  
SMDC-Huntsville  
RMI-EPA, Marjuro  
U.S. Army at Kwajalein Atoll

## **RESPONSES TO US FISH AND WILDLIFE SERVICE, PACIFIC ISLANDS FISH AND WILDLIFE OFFICE COMMENTS (JULY 22, 2010)**

### **Response to Comment #1**

For clarification, the PDV would weigh less than 3200 lb. As stated in Section 2.1.1.2 of the EA, the maximum payload mass capability for the Minotaur IV Lite booster, including the separation hardware, is approximately 3200 lb.

### **Response to Comment #2**

For clarification, the BOA alternative would involve up to three ocean going deck barges, each measuring approximately 100 ft wide and 300 ft long (see Section 2.1.2.3.1 of the EA). Collectively, the three barges would measure 300 ft by 300 ft.

### **Response to Comment #3**

For clarification, pre-test preparations to discourage migratory birds from feeding or nesting in the test area would minimize the risk to birds (see Sections 4.1.3.3.1 and 4.1.3.3.2 of the EA).

### **Response to Comment #4**

For clarification, the risks to sea turtles and sea turtle nests are considered low because: (1) prior survey records indicate few sightings of sea turtles or sea turtle nests at Illeginni Islet; and (2) pre-test preparations include surveys for sea turtle nests and coordination with the USFWS if nests with eggs are discovered (see Sections 3.3.3.1, 4.1.3.3.1, and 4.1.3.3.2 of the EA). Regarding the effects on migratory birds, see the response to comment #3.

### **Response to Comment #5**

For clarification, the underwater overpressures at the BOA test site may cause temporary threshold shift (TTS) for any marine mammals and sea turtles in proximity to the barges. The expected overpressures, however, would be below threshold levels for the onset of permanent threshold shift (PTS) (see Section 4.1.3.3.2 of the EA).

Although marine mammals and sea turtles could also be impacted by payload particles and other test vehicle debris, the NMFS determined that these underwater impacts are discountable because there would be a limited number of test events and because of the expected low density of Endangered Species Act-listed marine mammal and sea turtle species within the BOA (see Section 4.1.3.3.2 and Appendix E of the EA). The USAF assumes similar findings for other marine mammal species as well.

### **Response to Comment #6**

The USAF's CSM Demonstration is one of two hypersonic strike weapon programs planned for flight testing at USAKA/RTS within the next few years. The US Army's Advanced Hypersonic Weapon (AHW) is the other program proposed for testing. The Army plans to conduct two AHW flight tests (see Section 4.3.3 of the EA) as opposed to the single CSM Demonstration flight test. Because of program planning and scheduling issues, it is uncertain as to whether the CSM Demonstration or AHW will be the initial flight test conducted at USAKA/RTS.

Depending on the environmental effects resulting from the initial hypersonic strike weapon flight test at USAKA/RTS, the follow-on tests might require some modifications to the conservation measures described in the EA and in the USFWS's Biological Opinion on the Effects of the CSM Demonstration (see Appendix F of the EA). Because the Document of Environmental Protection (DEP) process (described in Section 1.8 of the EA) addresses all upcoming hypersonic strike weapon program tests at USAKA/RTS, the USAF suggests that the USFWS's nonbinding recommendation for an "adaptive

management plan” or modifications to the conservation measures would best be addressed during the DEP process and not in the CSM Demonstration EA.